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ROY (D. N.), GHOSH (S. M.) & CHOPRA (Sir R. N.). **Treatment of Scabies and Pediculosis with Pyrethrum.**—*Indian med. Gaz.* **76** no. 6 pp. 333–335, 2 refs. Calcutta, 1941.

A 10 per cent. ointment of finely powdered flowers of *Chrysanthemum* (*Pyrethrum*) *cinerariaefolium* with vaseline rubbed well into the parts of the body affected by scabies [*Sarcoptes scabiei*, DeG.], preferably in the evening, relieved the itching within 48 hours, and also had a rapid effect on secondary infections. It was not possible to ascertain the time needed for complete cure, but patients incapacitated by severe inflammation were usually able to resume work after three days. Treatment should be continued for a week after cure to prevent reinfestation. The ointment was also used with striking success against mange on rabbits and dogs.

In cases of infestation by *Pediculus humanus capitis*, DeG., or *Phthirus pubis*, L., rubbing the ointment well into the hair once daily in the evening for the incubation period of the eggs (5–10 days) killed the post-embryonic stages very rapidly. Immersion of the hair at similar intervals in a watery extract prepared by soaking 2 oz. coarsely powdered flowers in 1 pint water for half an hour and heating the water almost to boiling point for another half hour was effective, but slower in action, the lice dying in about 3 hours. No ill effects were noticed, even when the ointment was applied to the eyelids of children suffering from conjunctivitis and severe blepharitis as a result of infestation by *Phthirus pubis*.

Department of Entomology.—*Bull. Del. agric. Exp. Sta.* no. 227 (Rep. 1939–40) pp. 21–30. Newark, Del., 1940.

In the course of this report, it is stated (p. 28) that studies by W. A. Connell under the supervision of L. A. Stearns on salt-marsh mosquitos in Delaware indicated that abundant breeding occurred only in areas flooded by tides on less than eight days per lunar month and that little or none occurred in areas so flooded on as many as 25 days per lunar month.

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Studies on ticks (pp. 29–30) were principally concerned with *Dermacentor variabilis*, Say, the eastern vector of Rocky Mountain spotted fever [*R.A.E.*, B **26** 249]. D. MacCreary found the immature stages on 108 out of about 325 small rodents examined. More than half of the meadow mice [*Microtus*] were infested, one with 257 individuals. The meadow mouse appears to be the preferred host in Delaware and is very abundant in some parts, while in others the pine mouse [*Pitymys*] is more so. In addition to these hosts and white-footed mice [*Peromyscus*] on which they had been recorded in the previous year, larvae and nymphs were found on domestic rats and mice, the kangaroo mouse (*Zapus* sp.) and the common rabbit (*Sylvilagus* sp.). One individual of *Haemaphysalis leporis-palustris*, Pack., was taken on a meadow lark.

Adult ticks taken during a routine collection included one example of *Amblyomma maculatum*, Koch. It is possible that it came north in the nymphal stage on a migratory bird. Two infestations of *Rhipicephalus sanguineus*, Latr., discovered in November 1939, and both apparently caused by a dog shipped from Georgia to Delaware, are thought to have been stamped out.

Howell (D. E.), Stiles (G. W.) & Moe (L. H.). **The Hereditary Transmission of Anaplasmosis by** *Dermacentor andersoni* **Stiles.**—*Amer. J. vet. Res.* **2** no. 3 pp. 165–166, 14 refs. [Chicago, Ill.] 1941.

Anaplasmosis of cattle has already been shown to be transmitted by *Dermacentor andersoni*, Stiles [*R.A.E.*, B **29** 14, etc.] and to be transmitted hereditarily by other ticks [**12** 11, 197; **17** 97; **19** 114; **22** 164; **24** 173]. On 2nd May 1940, several adults of *D. andersoni*, one of which was replete, were collected from a naturally infected cow in Wyoming during the initial stages of the disease. Larvae that hatched from eggs laid by the replete tick were placed on the ear of a cow on 12th July and removed fully fed on 24th. Blood smears taken from the animal on 20th August showed numerous anaplasma bodies, and it developed clinical symptoms and was used as a carrier in subsequent transmission studies. Larvae from eggs laid by the remaining ticks failed to transmit the disease.

Tularemia Infection found in Fleas from Prairie Dogs in Wyoming.—*Publ. Hlth Rep.* **56** no. 30 p. 1521. Washington, D.C., 1941.

In 1941, N. E. Wayson reported the finding of tularaemia infection in a batch of 43 fleas taken from 24 prairie dogs (*Cynomys leucurus*) in Wyoming in June. It is believed that the only previous records of tularaemia in fleas in the United States are of infection of fleas obtained from three rabbits and a hare in Minnesota in 1933–35. Naturally infected fleas have also been found in Russia [*R.A.E.*, B **27** 241]. The fact that this is the first time that tularaemia has been produced in guineapigs at the plague laboratory in San Francisco by the injection of infected fleas emphasises the inefficiency of the flea as a vector of tularaemia as compared with its efficiency in the transmission of plague.

VARGAS (L.). *Simulium lane-portoi* **n. n. (Simuliidae, Dipt.) y lista de simúlidos mexicanos.** [*S. lane-portoi*, n. n., and a List of Mexican Simuliids.]—*Rev. Inst. Salub. Enferm. trop.* **2** no. 1 pp. 115–122, 14 refs. Mexico, D. F., 1941. (With a Summary in English.)

The author agrees with the view of Edwards [*R.A.E.*, B **20** 14] and others that *Eusimulium* is not generically distinct from *Simulium*, and proposes the new name *S. lane-portoi* for *S. pilosum*, Lane & Porto [**29** 188], which, on this view, is preoccupied by *S.* (*E.*) *pilosum*, Knowlton & Rowe (1934). He also gives a list of the Simuliids of Mexico, showing their synonymy and distribution in that country.

VARGAS (L.). **Aplicación taxonómica de un método estadístico.** [The Application to Taxonomy of a statistical Method.]—*Rev. Inst. Salub. Enferm. trop.* **2** no. 1 pp. 123–128, 4 figs. Mexico, D.F., 1941. (With a Summary in English.)

For facilitating specific identification of insects, the author uses a system of cards to supplement the usual keys. Illustrations of these are given for *Anopheles*. There are three master cards, one bearing all the characters of the eggs and male genitalia, another with characters of the larvae, and a third with characters of the females. The characters are shown by numbers along three of the edges. For the corresponding stages of each species there is a specific card in the edges of which slots are punched, so that when this card is superimposed on its master card the correct characters appear in the openings. Countries are indicated by letters or combinations of letters, along the fourth edge of the card.

It is suggested that if uniform master cards can be established, a species could be designated by the numbers and letters corresponding to the openings.

SAUNDERS (G. M.). **A Comparison of the Incidence of Filariasis (*Wuchereria bancrofti*) in the Islands of St. Thomas and St. Croix.**—*Amer. J. trop. Med.* **21** no. 3 pp. 481–485. Baltimore, Md., 1941.

During 1939 and 1940, blood samples from 200 persons living in St. Croix and 195 living in St. Thomas were examined for the presence of microfilariae. Filariasis caused by *Filaria* (*Wuchereria*) *bancrofti* has long been known to be prevalent on the former island, but little has been reported from the latter. Whereas microfiariae were found in the blood of 50 persons from St. Croix, they were found in only one individual from St. Thomas, and she had lived for five years in Porto Rico and made short visits to St. Croix. She had none of the physical abnormalities sometimes ascribed to filarial infection, but these were found in two other individuals. In St. Croix, four persons with microfilariae and 20 without showed such abnormalities. As *Culex fatigans*, Wied., the usual insect vector of *F. bancrofti* is common on both islands and they are only 40 miles apart, the difference in the incidence of filariasis is unexplained. It is suggested that it may be connected with the more urban way of life of the inhabitants of St. Thomas.

McIvor (B. C.) & Cherney (L. S.). **Studies in Insect Bite Desensitization.**—*Amer. J. trop. Med.* **21** no. 3 pp. 493–497, 2 refs. Baltimore, Md., 1941.

In continuation of previous experiments [*R.A.E.*, B **28** 28], a polyvalent flea antigen consisting of an extract of whole fleas of the two species, *Pulex irritans*, L., and *Ctenocephalides canis*, Curt., found to attack man in or near San Francisco was administered between January and October 1940 with encouraging results to 61 volunteers sensitive to flea-bites. The way in which the extract was prepared and used is described; the results were similar whether the injections were subcutaneous or intradermal. The treatment reduced the size of the wheal and its duration and decreased irritation. The relief associated with a single course lasted only 2–3 months in some individuals, but persisted in others. Most of the people treated claimed that they no longer found fleas on their person or in their clothing and that if a flea did get into their clothing it did not bite. Fleas confined in vials would, however, bite treated individuals free from flea annoyance. No circulating antibodies or precipitins were demonstrated in the blood of individuals treated with the antigen.

Experiments with *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, and white mice failed to show any correlation between the number of flea bites previously received and the time required for a group of fleas to feed. Six white rats were hosts to about 3,000 fleas in the course of 8 months, and at the end of that period the fleas still thrived on them. At the end of three years during which about 10,000 examples of *C.* (*Diamanus*) *montanus*, Baker, fed on one ground squirrel (*Citellus beecheyi douglasii*), the fleas would still draw blood from it but did not thrive, and the culture died out. Subcutaneous and intraperitoneal injections of a buffered saline extract prepared from *Ceratophyllus fasciatus* into white mice did not cause any change in the time required for the fleas to engorge on them. Fleas on guineapigs to which the *fasciatus* antigen was administered over a period of six weeks fed as well at the end of the experiment as at the beginning.

Niño (F. L.). **Miasis por larvas de** *Cochliomyia hominivorax* **(Coquerel, 1858), complicando un cáncer de labio. (Nota parasitológica.)** [Myiasis due to Larvae of *C. hominivorax* complicating a Cancer of the Lip.]—*Bol. Inst. Clín. quir.* **17** no. 141 pp. 510–522, 10 figs., 38 refs. Buenos Aires, 1941.

The author describes a case, observed in February 1939 in Buenos Aires, in which a cancerous lesion of the lower lip became infested by *Cochliomyia hominivorax*, Coq., 32 third-stage larvae of which were removed from it. Of these, 14 were kept in the laboratory; they pupated on the next day, and 3 males and 11 females emerged 9–10 days later. The larva, pupa and adults of both sexes are described. Records of cases of myiasis in man in Argentina are briefly reviewed, and it is concluded that *C. hominivorax* was responsible for most of them.

Yasuda (M.). **On the Morphology of the Larva of** *Wohlfahrtia magnifica* **Schin. found in the Wound of a Camel in Inner Mongolia.** [*In Japanese.*]—*J. Chosen nat. Hist. Soc.* **7** no. 29 pp. 27–36. Keijo, 1940.

Descriptions are given of the second- and third-instar larvae of *Wohlfahrtia magnifica*, Schin., taken from a wound on a camel in

Inner Mongolia, together with a review of the literature on myiasis due to this fly.

YOKOO (T.) & HOTARI (J.). **Studies on the blood-sucking Insects of Sheep in Korea. I. On the Species, Morphology and Bionomics of blood-sucking Flies.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **13** no. 1 pp. 14–38, 7 figs. Tokyo, 1941.

In Korea, *Stomoxys calcitrans*, L., and *Lyperosia irritans*, L., are common and widely distributed. All stages of *S. calcitrans* are described. In experiments, the adults survived for averages of 2·05 days without food, 7·2 days when fed on 3 per cent. sugar solution and 18·65 days when given citrated rabbit blood. Only those given rabbit blood oviposited, the preoviposition period being about 20 days. The adults emerge mostly in the daytime, and the females lay their eggs singly or in batches of up to 30 in horse dung, wet straw and other decaying vegetable matter [*cf. R.A.E.*, B **28** 205], the number deposited by a single female averaging 77·3. The eggs hatch in 1–2 days, the larval stage averages 13–75 days in horse dung, and the pupal stage lasts 8 days. A generation is completed in 17–48 days, usually in 21–30 in the second half of summer, and there are 4 or 5 generations a year. The flies are attracted by sunshine and attack newly shorn sheep as well as cattle, horses and other animals. Near Suigen, they appear in mid-May, increase in numbers in late June or early July, are most abundant in September and disappear in late November. In sheep yards, they increased considerably after the beginning of July, decreased in mid-August and increased again in late August and September.

Tsetse Research Report 1935–1938.—88 pp., 2 pls., 2 maps (1 fldg.), 6 figs., 20 refs. Dar-es-Salaam, Dep. Tsetse Res., 1940. Price 5*s*.

In this report on the work carried out by the Department of Tsetse Research, Tanganyika Territory, between January 1935 and December 1938, each species of *Glossina* studied is the subject of a separate section, and the reports of senior officers are incorporated in these sections under their names. C. H. N. Jackson was responsible for most of the work on *G. morsitans*, Westw. [*cf. R.A.E.*, B **25** 162]. He states that the period was occupied mainly with studies of population at Kakoma in southern Tabora [*cf. loc. cit.*; **29** 161, etc.], the results of which endorsed those obtained by the fly-round method [**19** 80], and at the end of 1938 with the effect of fire-exclusion [**29** 124, 161]. Game was scarcer in the unburnt than in the burnt square, but there was no observable difference in the hunger of the tsetses as tested by wet weights. A simplified technique for studying population that will give crude results in a few days was developed and has been used for other species. A catch of one old male of *G. morsitans* per linear mile seems to indicate a population of 100 old males per sq. mile. For *G. swynnertoni*, Aust., the results are not greatly different. It was possible to divide the blood corpuscles in fed tsetses into size groups, and evidence was thus obtained that wart-hog and bush-pig afforded some 60 per cent. of the food of *G. morsitans*, though in most areas they form far less than 60 per cent. of the ungulate game. These results and those obtained in a few precipitin tests suggest that this

fly needs to take pig blood every second or third meal. It also appeared to feed readily on elephant, sometimes on birds, and seldom on large antelope, buffalo and giraffe. Other experiments planned or in progress in other parts of Tanganyika and in Northern Rhodesia are outlined.

In the section on *G. swynnertoni*, W. H. Potts states that fly-rounds at Shinyanga since 1929 [**25** 91] and investigations in other belts have shown that this fly has substantially the same seasonal cycle as *G. morsitans*, *viz.*: recovery during the rains, often lasting into the early dry season, from the low point reached during the later dry season. The fire exclusion experiment [**22** 234] is being extended to include a whole belt of *G. swynnertoni*; its population has fallen considerably in the fire-exclusion area. The direct results of fire exclusion on the vegetation and fauna are described. The reduction in numbers of the tsetse is effected by a failure to recover during the rains, so that each successive dry season depresses the population further. This failure is thought to be due to increased activity of predators [*cf.* **29** 161]; there was no failure of the males to fertilise the females, and no increased mortality of pupae on account of the humidity of the grass-mat.

Observations at Shinyanga recorded by H. Harrison showed that *G. swynnertoni* was constantly present on giraffe and wart-hog, but never on zebra; the conclusion that it does not attack zebra was confirmed by precipitin tests [**25** 160]. Movements of giraffe into the area always coincided with increased numbers of the fly. Fire-exclusion changed the habitats of various species of game animals, gradually driving them out of the blocks. The numbers of *G. swynnertoni* caught per 10,000 yards on each of three fly-rounds in a block where fire-exclusion was introduced in 1931 were, respectively, 25·9, 27·2 and 9·8 in June 1936, 16, 19·6 and 5 in June 1937 and 7·1, 5·3 and 0·7 in June 1938.

Potts describes an investigation of the effect of a barrier of natural deciduous thicket about $\frac{3}{4}$ mile long and 300 yards wide produced by excluding fire, prolonged by an artificial belt of evergreen shrub (*Euphorbia tirucalli*) $1\frac{3}{4}$ miles long and 100 yards wide, lying along the road that divides the fire-exclusion block from the old control. Catches of *G. swynnertoni* along the protected side were substantially lower than those on the infested side of the barrier, the natural thicket being apparently as efficient as the planted barrier. Experiments with marked flies conducted by Potts and by Jackson indicated that the barrier fails to stop passage completely, but impedes it considerably.

J. Y. Moggridge records investigations on *G. pallidipes*, Aust., under the coastal conditions at Kilifi in Kenya. The vegetation, game and climate of the experimental area are described. The fly was distributed throughout all types of vegetation except cultivation. During the wet season, it spread from the denser thicket into the lighter thicket near the shore. There was no concentration along the edges of roads or other open spaces. The population rose during wet and fell during dry periods. Activity also fluctuated with humidity and to a smaller extent with temperature. The tsetses were always well fed, owing to the abundance of animals. In an area 100 acres in extent where all undergrowth was cut away and the trees and shrubs left, 2·5 individuals of *G. pallidipes* were taken in an hour as compared with 66 in the main thicket 140 yards away. It is hoped by clearing undergrowth in this way and burning the trash to induce grass growth and thus make the clumps of thicket useful as grazing.

H. M. Lloyd states that in 1938 trypanosomiasis of cattle was more prevalent at Mpwapwa, Tanganyika, than ever before, probably because of climatic conditions favourable to *G. pallidipes*, failure to complete the barrier clearings recommended in the past, and the driving effect of a fierce grass fire from inside the tsetse area in 1937. He gives an account of measures taken to clear enough bush to provide the cattle with safe grazing and make it possible to forbid grazing on the hillsides, which leads to erosion and often exposes the cattle to attack while they are passing through other types of vegetation on their way to the hills. The clearings have had a very beneficial effect.

Potts reports that the bionomics of *G. pallidipes* in Shinyanga are unusual; it appears to be more numerous during the dry season than at other times. Possible explanations of this are discussed. The Shinyanga fly-rounds afford no evidence that it has increased under fire-exclusion. Its numbers were in fact decreasing, both on a plot burnt annually up to 1936 and on others that had not been burnt for eight and five years, respectively.

Moggridge reports that, like *G. pallidipes*, *G. brevipalpis*, Newst., and *G. austeni*, Newst., are both found in all three types of vegetation at Kilifi on the Kenya coast, but that *G. brevipalpis* is found in greatest numbers in the forest. It is active almost exclusively at dawn and dusk. The numbers of *G. austeni* taken were everywhere comparatively small, because it is not attracted to the bait-cattle. Searches for pupae revealed that its density must be great and that it is distributed evenly throughout homogeneous vegetation. Its activity is related to humidity, being greatest in the early morning. During the dry season, large numbers of hungry flies of this species are taken at night, but after the break of the rains, individuals may still be taken at night in quite fair numbers, but they are then no longer hungry. Lloyd describes trapping experiments on Maboko Island, Kenya, with particular reference to *G. palpalis fuscipes*, Newst. The traps caused a rapid and marked initial reduction in the density of this fly, but did not reduce it further when their intensive use was continued. The numbers of *G. brevipalpis* caught in the traps were very small, probably owing to its crepuscular habits. A light-trap was slightly more effective, but no very large totals were taken. It was most successful when placed in a small clearing, but only caught well when hippopotamus appeared there.

Potts describes laboratory investigations on the fluctuations in tsetse populations and differences in the behaviour of tsetses in captivity and in the field and means of minimising them. Complete inundation of the soil killed all pupae in 10 days, 94–95 per cent. in 2–3 days, and nearly 50 per cent. in one day, while partial saturation increased mortality considerably. Pupae of *G. swynnertoni* kept at a mean temperature of about 16°C. [60·8°F.] took on the average 104½ days to develop, and only 6 flies, too weak to feed, emerged out of 20 pupae. Another series kept under these colder conditions during the night took on an average only 53 days to develop, and 18 normal flies emerged from 21 pupae.

J. Ford records an experiment indicating that predators, principally *Pheidole* spp., kill a significantly higher proportion of pupae of *G. morsitans* in unburnt than in burnt bush [**29** 161]. It appears that during the first few years of fire-exclusion, pupae are increasingly open to attack, though later there is a stabilisation of predatory action

at a high level. It is thought that additional losses of pupae in unburnt bush are due to the extension of the range of the ants by modification in the habitat. F. L. Vanderplank describes the use of test sera to identify the blood meals of tsetses by agglutination.

Other sections and appendices deal with various subjects, including surveys, reconnaissances and the clearings made by or under the supervision of the department, and one gives a list of publications and lectures by members of the staff.

JACK (R. W.). **Report of the Division of Entomology** [Southern Rhodesia] **for the Year ending 31st December, 1939.**—35 pp. typescript. [Salisbury, S. Rhod.] 1940.

The major portion of the medical and veterinary section (pp. 12–26) of this report deals with work against *Glossina* spp. [*cf. R.A.E.*, B **28** 50]. In the northern districts, the position with regard to *G. morsitans*, Westw., is very satisfactory. The formerly infested country that had been cleared of fly by the end of the year amounted to at least 6,000 sq. miles. The infested areas in these districts are now relatively remote from the European settlement, although settlement is being extended in two sections as a result of the retreat of the fly. In all the districts, native cattle have been returned to areas from which they had been driven by the encroachment of the fly, and many roads closed to ox transport have been reopened. While the reduction in game that is involved [**27** 20] is regretted, the result could not have been achieved within economic limits by any other measure.

In the Chipinga subdistrict (Melsetter Border), trypanosomiasis caused serious loss of cattle during the year. The border clearing [*cf.* **27** 20] has been crossed, apparently freely, by tsetse flies during the past two years, in spite of annual widening at suspected weak places. The deterioration in the position may be due to an increase in the density of the fly on the Portuguese side of the clearing. *G. brevipalpis*, Newst., apparently crossed the clearing more freely than *G. pallidipes*, Aust. This might be due to a possible greater density of the former species on the edge of the clearing or to its crepuscular and nocturnal habits. Its predominance considerably affects the usefulness of traps as it is not readily taken in them [*cf.* **29** 109–110 ; **30** 7]. The advance of *G. morsitans* in Portuguese territory towards the border at the southern end of the Melsetter district [**28** 50] has apparently continued. The operations against *Glossina* spp. in individual districts are surveyed in detail by J. K. Chorley.

Chrysomyia bezziana, Villen., continues to be a serious pest of cattle in many localities. Several cases of infestation of man by *Cordylobia anthropophaga*, Grünb., were reported at Salisbury as well as two cases of intestinal myiasis due to unidentified species of *Sarcophaga* and a case of the infestation of the urinary tract of a European child by a Coleopterous larva. *Anopheles funestus*, Giles, was unusually common in the neighbourhood of Salisbury from March to July, and *A. gambiae*, Giles, was very abundant during April at a camp in the Hartley district and was observed to bite man during the daytime. *Culicoides inornatipennis*, C., I. & M., caused much annoyance at various localities in the Wankie district during the months of May and December.

MacCreary (D.). **Report on the Tabanidae of Delaware.**—*Bull. Del. agric. Exp. Sta.* no. 226, 41 pp., 7 figs., 21 refs. Newark, Del., 1940.

The following is based on the author's summary : Tabanids are of considerable economic importance in the marsh areas of Delaware, both on account of their actual feeding and as potential vectors of livestock diseases. The methods by which immature forms were collected and reared are described. Emergence cages placed in various marshes took eight species. *Chrysops fuliginosa*, Wied., emerged from soil that was covered twice daily by tides, and six other species of this genus emerged from extremely wet marsh that was inundated occasionally by heavy rains. Twenty species of Tabanids were reared from collected larvae or pupae. Pupation records for some are presented, and the plant and water relationships of certain larval habitats are described.

Adults of 55 species were collected, and two others were reared, making a total of 57 species for the State. In addition, two varieties and one subspecies were collected. Mosquito light-traps on lighthouses in the Delaware Bay, 3·2–8·4 miles from land, captured 412 individuals belonging to 10 species, including a considerable number of males. This indicates that the males are not so closely restricted to the breeding areas as is generally believed. Pairing was observed in *C. fuliginosa* and egg deposition in *C. flavida*, Wied., and eggs of other species were found. The feeding of the adults was not confined to blood ; certain species fed on the products of fermentation. Species of *Chrysops* are more prone to attack man than those of other genera present in Delaware. It is rare for a decided reaction to be shown to their bites, but this may occasionally occur. Five species of *Tabanus* were observed feeding on man. Cattle and horses, especially animals on and near the marshes, were severely attacked.

No pupal parasites were discovered. *Telenomus emersoni*, Gir., which is thought to be recorded here for the first time from the Atlantic coast, was reared from the egg-mass of a Tabanid, probably *Tabanus lineola*, F., an undescribed Nematode of the genus *Hexamermis* was obtained from *Chrysops* larvae, Erythraeid mites were found on a female of *T. lineola*, and the Sphegid, *Stictia carolina*, F., and the Asilid, *Erax aestuans*, L., were observed feeding upon adult Tabanids. Undetermined species of spiders were also seen capturing adults. Tabanids are very susceptible to fly-sprays [*R.A.E.*, B **25** 174], but as they are not present on livestock in stables where sprays are generally applied, they are not exposed to their action. When sprayed animals arrive in the pasture, little but the possible repellent action remains.

Drainage, which is advocated where it is consistent with good agricultural practice [**12** 156], would be of little value in the salt marshes of Delaware. In the higher situations where drainage ditches for mosquito control have been installed on thousands of acres of marsh, the water table has been lowered, and this has probably made certain areas unsuitable for Tabanid larvae, but there is some indication that the ditches, which usually contain water, have created as many opportunities for breeding as they have eliminated.

Howell (D. E.), Stiles (G. W.) & Moe (L. H.). **The Transmission of Anaplasmosis by Mosquitoes (Culicidae).**—*J. Amer. vet. med. Ass.* **99** no. 773 pp. 107–110, 8 refs. Chicago, Ill., 1941.

Earlier work on the transmission of anaplasmosis of cattle by Arthropods is briefly reviewed. As mosquitos (particularly species of

Psorophora) occur in large numbers on cattle during the anaplasmosis season, their ability to act as vectors was tested in Oklahoma. The materials and methods used are described. *Psorophora* spp. were obtained as pupae from pools on grazing land, and a few laboratory-bred individuals of *Aëdes aegypti*, L., were included. When representatives of five species of *Psorophora* were partly fed on a carrier and immediately transferred to another animal on which they fed to repletion, no transmission occurred. An animal that received about 1,525 bites in three days from females of *P. ciliata*, F., and *P. confinnis*, Lynch (*columbiae*, D. & K.) that had obtained their infective feed immediately before from a clinical case developed symptoms of anaplasmosis with a rise in temperature, 38 days after the first feed, and smear preparations were positive. In a third experiment, about 200 females of the same two species were partly fed on a convalescent cow on 19th–22nd June and immediately afterwards on the test animal, 21 females of *A. aegypti* were fed between 28th June and 1st July on a clinical case that later died of the disease and immediately afterwards on the same test animal, and 22 more females of *P. ciliata* were fed on 9th July on the same two animals. The test animal's temperature rose on 15th August, and *Anaplasma* bodies were numerous two days later. It developed typical anaplasmosis and later recovered.

It is thought that mosquitos, especially *Psorophora* spp., may be the vectors of the occasional cases of anaplasmosis that occur during the summer and are apparently not due to mechanical transmission resulting from herd management or to transmission by ticks or Tabanids. Most species of *Psorophora* breed in temporary pools, and develop from eggs that were laid before the pool was filled with water and that may have remained dormant for a long time. When conditions become suitable for development, it takes place very rapidly, and large numbers of adults appear at the same time and feed voraciously on the cattle during the anaplasmosis season.

Smith (C. E.), Livengood (E.) & Roberts (I. H.). **The Value and relative Effectiveness of Preparations of Rotenone, Derris Powder and Cubé Powder as Larvicides for Cattle Grubs.**—*J. Amer. vet. med. Ass.* **99** no. 776 pp. 391–394, 9 refs. Chicago, Ill., 1941.

Experiments were carried out in Colorado in 1938 and 1939 and in Missouri in 1940 to determine the relative values of rotenone, derris powder and cubé powder in washes for the control of *Hypoderma* larvae on cattle, the minimum effective strength of the washes, and the effect on cattle when the liquids were used during cold weather. The washes were applied to the back and upper parts of the sides of the cattle with stiff brushes at the rate of about 1 U.S. pint per animal. As only one application was made to each herd, and observation in Colorado had shown that the larvae, after making a hole in the skin, usually remained in the subdermal tissues for 30 days, the application was made 30 days after the first holes appeared in the herd. *H. lineatum*, Vill., was the only species found.

There was no difference between the effectiveness of derris and cubé washes, but both were more effective than chemically pure rotenone or a preparation containing 90 per cent. rotenone. Derris and cubé powders containing 4 per cent. rotenone were as effective as those containing 5 per cent., and washes made with 12 oz. powder to 1 U.S. gal. water were as effective as those made with 16 oz. and were safe

and efficient [*cf. R.A.E.*, B **29** 119], but washes containing only 8 oz. powder were not fully effective. Single treatments of infested cattle with washes made of 12 oz. derris or cubé, 4 oz. soap flakes and 1 U.S. gal. water gave 90–100 per cent. kill. The variation was thought to be caused by some larvae appearing after the treatment had ceased to be effective or on untreated parts of the body. No visible injury was caused to the cattle by any wash applied during the cold weather, though the liquid immediately froze on them.

VARGAS (L.). **Nota sobre el papel que se atribuye a los Chloropidae en la transmisión de enfermedades.** [A Note on the Part attributed to Chloropidae in the Transmission of Diseases.]—*Medicina* **21** no. 391 pp. 306–310, 13 refs. Mexico, D.F., 1941.

In the course of an epidemiological survey in June–August 1933 at Rio Balsas, a locality in the district of Guerrero, Mexico, numerous cases of conjunctivitis were observed. About 10 per cent. of adults and 30 per cent. of children under 15 were affected. The disease was apparently transmitted by Chloropids, which together with blood-sucking flies, were common in the district. The literature on the transmission by flies, chiefly species of *Hippelates* [*cf. R.A.E.*, B **29** 144], of conjunctivitis and of *Spirochaeta* (*Treponema*) *pertenuis*, the causal agent of yaws, is reviewed.

MAZZOTTI (L.). *Ornithodoros dyeri* **en México.**—*Medicina* **21** no. 392 pp. 313–314, 2 refs. Mexico, D.F., 1941.

Five examples of a species of *Ornithodoros* found together with *O. coprophilus*, McIntosh, on the dung in a cave harbouring bats in Chiapas [*R.A.E.*, B **29** 145] were identified as *O. dyeri*, Cooley & Kohls [*cf.* **28** 245]. Both ticks were observed in November 1940 on dung in a disused saltpetre mine in Colima infested with bats. They were not taken on the bats, and nymphs and adults did not feed when placed on them. None of the collecting party was bitten by them. The characters are given of the sexes of *O. dyeri*, which had not previously been differentiated.

VARGAS (L.). *Anopheles* (*Anopheles*) *gabaldoni* **n. sp. del Estado de Tabasco, México.** (**Dipt. Culicidae.**)—*Medicina* **21** no. 395 pp. 385–394, 7 figs. Mexico, D.F., 1941.

The author describes *Anopheles gabaldoni*, sp. n., from males and females bred from larvae collected in the State of Tabasco, Mexico, and gives a list, arranged by subgenera and series of the American species of *Anopheles*, including the new species, which is closely allied to *A. shannoni*, Davis. The differences between the females of these two species are stated.

DE LEÓN (J. R.). **La formación de razas en los** *Anopheles* **guatemaltecos.** [The Formation of Races in Guatemalan *Anopheles*.]—*Ciencia* **1** no. 8 pp. 349–352, 3 figs., 1 map, 4 refs. Mexico, D.F., 1940.

The distribution of *Anopheles albimanus*, Wied., in Mexico is restricted to humid regions [*R.A.E.*, B **27** 122], but the author has found it established in Guatemala in a dry, desert environment.

Larvae were observed throughout the year in water in the hoof-prints of cattle near a spring in a sandy plain with a scanty vegetation of thorn bushes and cactus and little water, and they were associated with *A. pseudopunctipennis*, Theo., a species well established in the region, and with *Culex stigmatosoma*, Dyar, and *Psorophora pygmaea*, Theo. It is probable that *A. albimanus* was introduced into the locality from the Atlantic coast by means of the railway, which passes near, and that it has been responsible for serious epidemics of malaria that have occurred in the neighbourhood. The author has also found it to be established in other very dry localities in Guatemala at elevations of up to about 4,000 ft. [*cf.* **24** 291]. At one point at about 3,000 ft. near the eastern frontier, where the dry and wet seasons are very pronounced, its races *bisignatus*, Hffm., and *trisignatus*, Hffm. [**27** 122] were observed. In this district, its larvae occurred in river pools exposed to the sun, and those of *A. punctimacula*, D. & K., in shaded sites, while larvae of *A. pseudopunctipennis* and *A. argyritarsis* R.-D., were very common.

The author states that *A. guatemalensis*, De León,* is a race of *A. chiriquiensis*, Komp [**25** 73], and it is further stated in an editorial footnote that *A. chiriquiensis* is a synonym of *A. parapunctipennis*, Martini [**22** 56]. Race *guatemalensis* is widely distributed in Guatemala and probably occurs in other Central American countries. It is zoophilous, and all the breeding places observed have been situated at altitudes of not less than about 4,000 ft.

VARGAS (L.). **Detalles morfológicos poco o nada conocidos de *Anopheles* mexicanos.** [Little or not known morphological Details of Mexican *Anopheles*.]—*Ciencia* **2** no. 2 pp. 66–69, 11 figs., 3 refs. Mexico, D.F., 1941.

From a study of the structure of the pharynx of Mexican Anophelines it is shown that females of *Anopheles pseudopunctipennis*, Theo., and *A. hectoris*, Giaquinto, can be distinguished by pharyngeal characters from those of *A. crucians*, Wied., *A. parapunctipennis* var. *guatemalensis*, De León, *A. quadrimaculatus*, Say, *A. aztecus*, Hffm., or *A. vestitipennis*, D. & K. These Anophelines belong to the subgenus *Anopheles*, and it is confirmed that in America, as in other parts of the world, members of this subgenus have no pharyngeal armature. Females of *A. albimanus*, Wied., *A. strodei*, Root, and *A. argyritarsis*, R.-D., the three species of the subgenus *Nyssorhynchus* studied by the author, are distinguished by differences in their pharyngeal armature.

The postspiracular structures of the larvae of the genus *Anopheles* in Mexico are briefly described and compared with those of *Chagasia bathanus*, Dyar, which appear to be similar. The author suggests that they serve to hold the bubble of air to the spiracles when the larva submerges.

KNOWLES (F. L.), PARKER (W. V.) & JOHNSON (H. A.). **Observations on the Use of "Phenol" Larvicides for Mosquito Control.**—*Publ. Hlth Rep.* **56** no. 33 pp. 1637–1641. Washington, D.C., 1941.

Commercial phenol larvicides containing cresylic acid in sulphonated oil have recently been used in some parts of the United States for the

* The paper in which *A. guatemalensis* was described has not been received by the Institute.

control of various mosquito larvae. For this work, a compound having a phenol coefficient of 10–14 is diluted with 30 parts water and applied as a fine spray. In laboratory and field experiments in May and June 1941, however, phenol larvicide diluted and applied in this way at rates of 10–95 U.S. gals. per acre proved much less effective than kerosene against larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) or *Anopheles quadrimaculatus*, Say, and was harmful to fish. In the laboratory, at the rate of 50 U.S. gals. per acre, it gave complete kill of goldfish and only 16 per cent. kill of larvae of *C. fatigans*.

Topping (N. H.). **Rocky Mountain Spotted Fever. A Note on some Aspects of its Epidemiology.**—*Publ. Hlth Rep.* **56** no. 34 pp. 1699–1703, 1 fig., 5 refs. Washington, D.C., 1941.

In spite of published statements to the contrary, it has long been believed that Rocky Mountain spotted fever is more virulent in the western United States than in the east, and laboratory observations have lent support to the belief, as western strains were more pathogenic to guineapigs than eastern ones. Recently, however, strains highly virulent to these animals have been isolated in the east, including two from *Dermacentor variabilis*, Say, in Georgia [*R.A.E.*, B **29** 126], and, during the summer of 1940, a strain isolated from a typical case of the disease acquired in Wyoming, the centre of the territory infested by *D. andersoni*, Stiles, was found to be extremely mild for guineapigs. It therefore became clear that the terms " eastern " and " western " or " *variabilis* " and " *andersoni* " were not applicable to the strains, which would be better classified according to their virulence for guineapigs. Comparable data for States in the two areas are given showing that there is no difference in the fatality rates for cases in comparable age groups, but whereas the disease is principally one of adult males in the west, children form a high percentage of the eastern cases. The possible reasons for this are discussed.

Davis (G. E.). *Ornithodoros turicata:* **The Male; Feeding and Copulation Habits, Fertility, Span of Life, and the Transmission of Relapsing Fever Spirochetes.**—*Publ. Hlth Rep.* **56** no. 36 pp. 1799–1802, 1 ref. Washington, D.C., 1941.

When twelve male adults of *Ornithodoros turicata*, Dugès, that had been reared individually from the egg were placed on an appropriate host at regular intervals and allowed to engorge completely, they fed every three or four weeks. They became as fully distended with blood as the females or immature stages. In 100 observations, the time required for engorgement varied from 6 to 23 minutes, and for copulation from 12 to 60 minutes. When 14 virgin males and 10 males that had paired before were mated with virgin females, the percentages of eggs to hatch were 53 and 68, respectively, and when one male mated for the 28th and 29th times, on both occasions with virgin females, 73·8 and 95 per cent., respectively, of the eggs laid by the females hatched. All the twelve males were infected with relapsing-fever spirochaetes (Texas or Kansas strains); most of them had been fed as nymphs on infected rats, and one had aquired infection through the egg. In 242 test feedings, they transmitted the spirochaetes 180 times. Four transmitted them at every feed, and seven transmitted them irregularly; one effected transmission seven times

in the first eight feeds, but failed in the following 21 feeds. Females that had paired with infective males and the progeny of these females in the larval and nymphal stages failed to transmit spirochaetes to white mice or young white rats. In humidity jars at a varying laboratory temperature, the length of life of eleven males varied from 15 to 36 months. At the end of 36 months, one male was still alive and feeding and mating normally.

BRIGHAM (G. D.). **Two Strains of Endemic Typhus Fever Virus isolated from naturally infected Chicken Fleas** (*Echidnophaga gallinacea*).—*Publ. Hlth Rep.* **56** no. 36 pp. 1803–1804. Washington, D.C., 1941.

A strain of endemic typhus was isolated from a batch of 135 individuals of *Echidnophaga gallinacea*, Westw., recovered from two Norway rats [*Mus norvegicus*] trapped on a farm in Georgia in May 1939. The owner of the farm was at the time suffering from typical endemic typhus. Additional strains were recovered from the pooled brains of the rats as well as from batches of 5 individuals of *Xenopsylla cheopis*, Roths., and 7 of *Leptopsylla segnis*, Schönh., combed from them. In September 1939, a strain was recovered from the brain of a rat from Albany, Georgia, and from a batch of 30 individuals of *E. gallinacea* combed from it. Both the strains from *E. gallinacea* were transmitted through series of guineapigs, many of which developed typical infection. For each strain, cross-immunity with three known strains of endemic typhus and with the other was demonstrated. Rickettsiae were found in smears from the tunica vaginalis of the guineapigs through which the infection was passed, and the brains of some of the animals were found to be positive for the characteristic typhus lesions. Inoculated rabbits produced agglutinins for Proteus OX19.

NEIVA (A.) & LENT (H.). **Sobre um novo triatomideo chileno: *Triatomaptera porteri*. Nota previa.** [On a new Chilean Triatomid, *T. porteri*. Preliminary Note.]—*Brasil-Medico* **54** no. 15 pp. 265–267, 4 refs. Rio de Janeiro, 1940.

MAZZA (S.), JÖRG (M. E.) & GAJARDO TOBAR (R.). **Estudios sobre Triatomidae. Debatida posición sistemática de un triatomideo chileno.** [Studies on Triatomids. The debatable systematic Position of a Chilean Triatomid.]—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 50, 34 pp., 24 figs., 8 refs. Buenos Aires, 1941.

In the first of these papers, the authors state that they have received from C. E. Porter three apterous males and two apterous females of a Triatomid collected in the Province of Coquimbo, Chile, by R. Gajardo Tobar and considered by him to be *Triatoma spinolai* Porter, which was described in 1933 from winged males. They consider that these apterous bugs are distinct from *T. spinolai* and propose for them the name *Triatomaptera porteri*, gen. et sp. n., giving descriptions of both sexes.

The authors of the second paper point out that in March 1940 they erected the genus *Mepraia* for *Triatoma spinolai* [*R.A.E.*, B **28** 200], as the specimens of this species then available to them comprised apterous females collected by Gajardo and a winged male from Porter's collection, and that *Mepraia* has priority over *Triatomaptera*. They

review examples of alar polymorphism in several species of Heteroptera and describe in detail the genitalia of a winged and an apterous male of *M. spinolai*. Those of the apterous form proved to be rudimentary, but the authors do not consider this difference to be of specific rank. Unless the two forms are shown by breeding experiments to be distinct, *Triatomaptera porteri*, with apterous males, should be regarded as a form of *M. spinolai*. All known females of this species are apterous. It is stated in both papers that examples of this Triatomid were found by Gajardo to be infected with *Trypanosoma* (*Schizotrypanum*) *cruzi*.

HURST (H.). **Insect Cuticle as an asymmetrical Membrane.**—*Nature* **147** no. 3726 pp. 388–389, 6 refs. London, 1941.

Results similar to those obtained on the permeability of the lipoid layer of the insect cuticle [*R.A.E.*, B **29** 79–81] have since been obtained with the outer cutinised layers of a number of plant epidermal membranes, the physical and chemical properties of which are said to resemble those of the lipoid layer in insects. This suggested that induced penetration of polar substances might take place with simpler artificial membranes, and the permeability of thin rubber was found to be similar. The importance of the physico-chemical relation between a membrane and the permeating substance in determining whether the permeability of the membrane to the substance might be modified by the introduction of other components is stressed by the citation of a number of examples, and as an illustration of the practical application of the findings to the control of insects, it is stated that though a mixture of ethyl alcohol and kerosene is very toxic to *Calliphora* larvae [*loc. cit.*], mixtures of ethyl alcohol with oleic acid or castor oil are only slightly toxic.

Insect cuticle possesses a high degree of asymmetry depending on the association between the external hydrofuge lipoid layer and the internal hydrophil protein-chitin complex. The way in which this asymmetry affects the permeability of the whole cuticle and is modified in different insects by the relative distribution and physical properties of the soluble and insoluble components of the cuticle framework is discussed.

O'KANE (W. C.), GLOVER (L. C.), BLICKLE (R. L.) & PARKER (B. M.). **Penetration of certain Liquids through the Pronotum of the American Roach. Studies of Contact Insecticides XIV.**—*Tech. Bull. N. H. agric. Exp. Sta.* no. 74, 16 pp., 8 figs. Durham, N.H., 1940.

The results are given in this report of studies designed to measure the rate and amount of penetration of liquids through a detached piece of the integument of an insect observed in a specially designed apparatus. The apparatus and procedure are described. The integument used was the pronotum of a cockroach [*Periplaneta americana*, L.] and the liquids studied were mostly alcohols and oils. Penetrations are given in tables. No conclusions are drawn.

BONNE (C.), LIE KIAN JOE, MOLENKAMP (W. J. J.) & MREYEN (F. W.). *Wuchereria malayi*, **de macrofilaria behoorende bij de** *Microfilaria malayi*. [The Macrofilaria of *M. malayi*.]—*Geneesk. Tijdschr. Ned.-Ind.* **81** no. 28 pp. 1487–1501, 2 pls., 14 refs. Batavia, 1941. (With a Summary in English.)

Adults of both sexes of *Filaria* (*Wuchereria*) *malayi* are described from a patient from Bantam (Java). Their structure corresponds

in general with the description given for the first time by Sundar Rao & Maplestone from material obtained in South India [*R.A.E.*, B **28** 167].

CHUNG (Hu[e]i-lan) & FENG (Lan-chou). **Further Observations on Natural Infection of *Phlebotomus chinensis* in Peiping with Leishmania Flagellates.**—*Chin. med. J.* **59** no. 6 pp. 540–542, 1 ref. Peking, 1941.

During the period 10th June–6th July 1940, 57 recently fed females of *Phlebotomus chinensis*, Newst., were collected in Peiping from a kennel occupied since 8th June by a 3-year-old dog that had had symptoms of canine general leishmaniasis since February 1940. Smears made from the lesions of its face on 10th June showed numerous L.-D. bodies. A child living in a house 280 yards from the one in which the dog had been until 8th June had had kala-azar some two years previously. The dog died in August, and examination revealed leishmaniasis involving the skin, spleen, liver and bone marrow. When the sandflies were dissected 3–7 days after collection, 34 were found to be infected with flagellates indistinguishable from those of *Leishmania donovani*, all of which were in the midgut except in one individual, which had a heavy infection extending from the midgut to the proboscis. A saline suspension of flagellates from two of the sandifles infected in the midgut was inoculated subcutaneously into a normal hamster [*Cricetulus*], and when it was killed, about 10 months later, *L. donovani* was found to be numerous in its spleen, liver and bone marrow.

JETTMAR (H. M.). **The Use of Pyrethrum Powder in Colloidal Solution as a Larvicide.**—*Chin. med. J.* **59** no. 6 pp. 565–569, 8 refs. Peking, 1941.

The action of pyrethrum in colloidal solution in water on larvae and pupae of *Culex* and *Armigeres* was observed in Hanchung, where the stone tanks in which water is stored for fire fighting made ideal breeding places for these mosquitos. The two genera did not differ in susceptibility. The dilutions of the powder tested included 1 : 10,000, which killed the larvae quickly, 1 : 20,000, which killed them in several hours, 1 : 50,000, which killed about half of them in 20 hours, and 1 : 100,000, which had only a slight and transient effect. Pupae were much more resistant, some surviving exposure for 24 hours to a dilution of 1 : 10,000. The pH of the water, within the range 5·5–8·5, had little, if any, influence on the action of the pyrethrum. The treatment of the water tanks with pyrethrum in a dilution of 1 : 20,000 [1 oz. to 125 gals.] resulted in a complete kill of larvae, but some pupae survived. Larvae of *Anopheles hyrcanus*, Pall., taken from ditches near Chungking in the autumn of 1939 were even more susceptible, as they were killed by exposure for 24 hours to dilutions up to 1 : 50,000. Other experiments showed, however, that though the larvae were easily killed in the hot weather, those treated in the cold season could recover if transferred to fresh water after they had apparently been seriously affected by the pyrethrum. In the field, it was ineffective against this Anopheline when the water was flowing, but killed practically all the larvae in stagnant water in a small ditch 28 yards long, 11–20 inches wide and 2 inches deep when $1\frac{3}{4}$ oz. was strewn so as to produce a long-lasting film on the surface.

Menon (T. Bhaskara) & Ramamurti (B.). **The Behaviour of the infective Larvae of *Wuchereria bancrofti* with special Reference to their Mode of Escape and Penetration of Skin.**—*Indian J. med. Res.* **29** no. 2 pp. 393–401, 1 pl., 5 refs, Calcutta, 1941.

The mechanism by which larvae of *Filaria* (*Wuchereria*) *bancrofti* escape from the labium of the mosquito, the conditions for entry into the tissues of the host, and the possibility of transmission through water [*cf. R.A.E.*, B **26** 132] were examined, using infective larvae obtained by releasing laboratory-bred females of *Culex fatigans*, Wied., in the mosquito nets of carriers of microfilariae. Patients with a very heavy microfilarial rate were unsuitable, as many of the mosquitos died as a result of the severity of the infection. When observed within the mosquito by powerful transmitted light, the mature larvae showed migratory movements whether they were in the abdomen or proboscis. When the proboscis was brought into contact with a cold or hot fluid, or even normal saline at room temperature, the larvae migrated back into the head and neck. When the possibility of larval escape into water was explored by examining water placed in a watch glass in cages containing mosquitos with fully-developed larvae and deprived of other food and drink, water into which stunned mosquitos containing fully developed larvae in the proboscis had been placed, and water into which mosquitos containing infective forms had fallen and in which they had died, the results were all negative if the bodies of the mosquitos were intact, but larvae escaped through minute breaches, such as the orifice made by pulling off a leg. All the larvae died soon after the death of the mosquito.

Warm fluids and irritants in contact with the proboscis and the mechanical bending of the labium with a needle as in biting all increased the activity of the infective larvae in the labium of stunned or recently dead mosquitos. If the fluid was too warm (40°C. [104°F.]), the larvae later died *in situ* or migrated back into the head and body. Fluid at about 36°C. [96·8°F.] caused active attempts to escape, but success could not be demonstrated. The effect of warm blood and saline at 37°C. [98·6°F.] placed in contact with the proboscis of a living and stunned infected mosquito was specially studied. In some cases, the labium was pushed up on the stylets and kept bent as in biting. Only when the mosquito sucked blood or saline placed on the proboscis with the labium bent were larvae seen to escape into the fluid around the proboscis, apparently through the extreme tip of the labella.

The behaviour of the infective larvae in the fluid, their size and morphology, the possibility of staining them, and their viability and growth *in vitro* are discussed. Mature larvae placed on unbroken skin of man and rodents in drops of saline were unable to penetrate the skin. Larvae directly deposited on a puncture or small cut in the skin failed to make their way into the tissues even though serum was oozing out, but when the larvae were dropped into the moist broken tissue, they continued to live and be active, and only when such exact placing was possible and there was no chance of drying did they migrate into the tissues. These results suggest that the mechanism of transmission has two parts, the provision of a stimulus for the larvae to penetrate the proboscis and the direct " inoculation " of the larvae into the tissues. The stimulus is shown to be active sucking of warm fluid by the mosquito. In biting, some larvae are deposited on the dry margins of the puncture, and these apparently die with the drying of the part.

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IYENGAR (M. O. T.). **Occurrence of *Wuchereria bancrofti* Infection in a Rural Area.**—*Indian J. med. Res.* **29** no. 3 pp. 677–679, 3 refs. Calcutta, 1941.

Infection with *Filaria* (*Wuchereria*) *bancrofti*, which in India was considered, like the vector *Culex fatigans*, Wied., to be characteristically urban [*cf. R.A.E.*, B **27** 46] and not to occur in association with malaria, has recently been observed in a typically rural area in Birbhum district, Bengal. Cases of filariasis were found in six villages, and an examination of 111 persons from two of them showed microfilariae in 19 and elephantiasis in 6 others. In all the villages in which filariasis was found, the incidence of malaria was high. A total of 61 mosquitos from two villages, including *C. vishnui*, Theo., *Ficalbia hybrida*, Leic., and five species of *Anopheles*, was examined for filarial infection with negative results, except for two out of 13 females of *A. philippinensis*, Ludl., which showed fully developed larvae, the measurements and morphology of which corresponded with those of full-grown larvae of *F. bancrofti* in experimentally infected *C. fatigans*. In a neighbouring village that also had endemic filariasis, 6 out of 104 individuals of *A. philippinensis* had well developed larvae. It is concluded that *F. bancrofti* in this area is transmitted by this Anopheline, which is also the vector of malaria. One female was found to be carrying both, the salivary glands showing a heavy infection with sporozoites while the labium and thorax contained many full-grown larvae of *F. bancrofti*.

VENHUIS (W. G.). **De vindplaatsen van geinfecteerde *Anopheles maculatus* tijdens een epidemie in Oost-Java.** [The Places where infected *A. maculatus* were found in the Course of a Malaria Epidemic in East Java.]—*Geneesk. Tijdschr. Ned.-Ind.* **81** no. 41 pp. 2178–2188, 1 pl., 10 refs. Batavia, 1941. (With a Summary in English.)

Anopheles maculatus, Theo., which is a dangerous vector of malaria in some regions but not in others, has only recently been found infected in East Java. In December 1940, a limited but severe epidemic of malaria was reported from hamlets in a teak forest district in the limestone hills of the Kediri Residency, and a survey was carried out in January 1941 in a village where a severe outbreak was in progress. Of the 140 inhabitants, 138 harboured malaria parasites, mostly heavy infections, and 112 showed gametocytes in the blood. Besides *A. maculatus*, other Anophelines were found, but all were rare except *A. vagus*, Dön., which is regarded as harmless. Of 433 females of *A. maculatus* caught in houses and stables by day and night, 393 were dissected. None contained oöcysts, and only one sporozoites. In view of the high proportion of gametocyte carriers, this poor result led to a search for resting places other than houses and stables. During this second survey, which was carried out from 11th to 21st February, when the epidemic was almost at an end owing to intensive quinine distribution and the flushing of the breeding places by heavy rains, 51 and 154 females of *A. maculatus* were caught in houses and stables, respectively, but none was infected. At the steep, shady and damp banks of small streams, however, 135 females and 22 males were taken, and of the 133 females that were dissected, one contained oöcysts and two sporozoites. All the females taken at the streams were

engorged, as compared with less than half those taken in houses and stables. Of a total of 18 of *A. minimus* var. *flavirostris*, Ludl., 8 were captured at the edges of streams and 10 in stables.

WERNECK (F. L.). **Os malófagos do boi e do cavalo.** [The Mallophaga of Cattle and Horses.]—*Rev. brasil. Biol.* **1** no. 2 pp. 195–199, 4 figs., 3 refs. Rio de Janeiro, 1941. (With a Summary in French.)

The only reference in the literature to the male of *Bovicola equi*, L., is that by Piaget, but examination of his material has shown that the specimen considered by him to be a male is an immature form. The author has found only one male among several hundred females of *B. equi* from horses in Brazil. He describes and figures it in some detail, together with the only known specimen of the male of *B. bovis*, L., from the Bedford collection.

Entomology.—*Rep. S. Afr. Inst. med. Res. 1940* pp. 26–29. Johannesburg [1941].

As was anticipated, *Anopheles gambiae*, Giles, which was found on the Witwatersrand early in 1939 [*R.A.E.*, B **28** 211], did not survive the winter there, and no larvae or adults have since been seen. A mosquito survey was made by De Meillon at Vaaldam, which was to become a port of call for flying boats making the journey between Lourenço Marques and Durban. Numerous breeding places were found, but the mosquito fauna was typical of the highveldt countryside, no domestic species such as *Aëdes aegypti*, L., being met with. *Culex fatigans*, Wied., and *Theobaldia* (*Allotheobaldia*) *longiareolata*, Macq., were found at Vereeniging, about 25 miles away. Experiments showed that the rickettsiae causing human tick-bite fever can be transmitted from the adult of *Haemaphysalis leachi*, Aud., through the egg to the succeeding generations. Typical infections were produced in guinea-pigs by allowing larvae, nymphs and adults bred from infected females to feed on them. Adults of the Anthomyiid, *Lispa afra*, Curran, and the Dolichopodid, *Tachytrechus bracteatus*, Wied., were observed seizing and feeding on Anopheline larvae. Material removed by stomach tube from a European, who gave a history of vomiting blood for three months together with " worms," yielded 14 larvae of *Fannia scalaris*, F., 4 of *Eristaloides* sp. and one of a Nitidulid.

MACLEOD (J.) & CRAUFURD-BENSON (H. J.). **Casual Beds as a Source of Louse Infestation.**—*Parasitology* **33** no. 2 pp. 211–213, 4 refs. London, 1941.

The acquiring of an infestation of *Pediculus humanus humanus*, L. (*corporis*, DeG.), unlike the maintenance of the infestation, does not depend on the individual concerned but on his environment. In this paper, an account is given of an examination of a common lodging house in East London, rather above the average in cleanliness, in an attempt to determine the part played by these hostels in spreading infestation by lice. During April 1940, the under-garments of 52 out

of 65 inmates were found to be infested, those of 24 with 1–10 lice only. Of 202 beds examined in May, 49 were infested, including 45 out of 140 beds that had been occupied for more than half the previous week. Of 12 beds occupied for four or more nights but empty on the night before examination, only one was infested, indicating that if a bed is left empty for a night or two, the infestation tends to disappear. In the 49 infested beds, 43 upper sheets, 18 lower sheets and 3 pillows were infested. The 316 lice included 97 adults. Infestation ranged from one louse in each of 17 beds to over 18 lice in two beds, one of which, a bed that had been slept in on the night prior to examination but not on the six previous nights, contained 117 lice. Of 17 beds that were known to be infested at the beginning of the week, only 8, all of which had been slept in for 4 or more nights, were infested at the end. It is assumed that in many of these cases of disappearance of infestation, the lice had been carried away by one or more of the persons who had occupied the bed in the intervening period.

BUXTON (P. A.). **Studies on Populations of Head-lice** (*Pediculus humanus capitis*: **Anoplura**). **IV. The Composition of Populations.**—*Parasitology* **33** no. 2 pp. 224–242, 4 figs., 15 refs. London, 1941.

The following is taken from the author's summary. In the three previous papers of this series [*R.A.E.*, B **24** 97; **26** 116; **28** 234], the author discussed the distribution of head lice (*Pediculus humanus capitis*, DeG.) among the hosts. In this final one, the composition of the louse populations themselves is studied from 858 infestations available from six places in four countries. About two-thirds of the infested heads harboured ten lice or less, the proportion of low infestations varying considerably from place to place. Infestations of over 100 lice never formed more than 10 per cent. of those from one place. In a single head, the proportion of the sexes was often far from equal. The total numbers of males and females from all the heads from one place differed significantly from equality, an excess of males occurring in one place, of females in another. In all heads from one place, the coefficient of correlation between the numbers of males and females was high, about 0·8–0·9. As the density of the louse population does not generally affect the sex ratio, the correlation is approximately linear, but when the density is unusually high, as in some heads from Colombo, the proportion of males rises progressively. This is the only case known in which the sex ratio of the louse is affected by an environmental factor. As regards the ratio of nymphs to females, there are great individual differences between heads, though the coefficient of correlation, worked on all the heads from one place, may be as high as 0·7 or 0·9. For all the heads from each place, the mean number of nymphs per female ranged between 5·4 and 10·9; many of the differences between places were significant. No explanation of these differences was found, and they do not seem to be affected by any environmental factor. The fact that the nymphs are always more numerous than the females indicates that there is a high mortality during nymphal life. In a sample of 502 nymphs that were specially examined, it was found that the death-rate in the third instar was higher than that in the other two, whereas it is lower in body lice (*P. h. humanus*, L.) reared in boxes.

LEESON (H. S.). **The Effect of Temperature upon the Hatching of the Eggs of** *Pediculus humanus corporis* **De Geer (Anoplura).**—*Parasitology* **33** no. 2 pp. 243–249, 1 fig., 2 refs. London, 1941.

The results are given of experiments carried out to ascertain the period of exposure to various temperatures necessary to kill all eggs of *Pediculus humanus humanus*, L. (*corporis*, DeG.). At the most favourable temperatures (between 29 and 32°C. [84·2 and 89·6°F.]), the incubation period was 7–11 days and up to 97 per cent. of the eggs hatched. Eggs hatched at temperatures between 24 and 37°C. [75·2 and 98·6°F.] but near these limits, the percentage hatch was reduced, and at the low temperatures the incubation period was extended to 17–21 days. Humidity did not affect the length of the incubation period, but extremely low or high humidities reduced the percentage hatch. No eggs exposed to 39°C. [102·2°F.] for two days or more hatched. When eggs were kept at 24°C. and then transferred to 32°C., the incubation period at 32°C. became shorter as the period at 24°C. became longer. No eggs hatched at 20, 22 or 23°C. [68, 71·6 or 73·4°F.], and they hatched on removal to 32°C. only if they had been exposed for less than 14 days to the low temperature. Short preliminary exposures to 20 and 22°C. lengthened the incubation period at 32°C. and long ones shortened it. Among eggs exposed for a preliminary period to 8, 10, 15, 18 or 19°C. [46·4, 50, 59, 64·4 and 66·2°F.] and then to temperatures between 30°C. [86°F.] and 32°C., none that had been exposed for 7 days or more to 19° or below hatched. Hatching of some of those that had been exposed for a shorter time began after the normal incubation period at the higher temperature. Eggs kept at 32°C. until nearly ready to hatch were able to do so at 23°C., and some did so at 18 or 19° ; many more exposed to 19°C. for 6, 7 or 8 days or 18°C. for less than 8 days hatched when returned to 32°C. Eggs exposed when nearly ready to hatch to 8 or 15°C. hatched when replaced in a favourable temperature if the period of exposure to the low one had not exceeded 8 days. In a few experiments in which partly developed eggs were exposed to 15°C. for 1–10 days, development ceased but was resumed when they were returned to 32° if the period at 15° had not exceeded 7 days. A table is given showing the minimum periods of exposure to constant temperatures of from 8 to 23°C. necessary to ensure complete mortality of newly deposited and older eggs. It shows that to kill a mixed batch of eggs, a temperature not above 15°C. and an exposure of at least 9 days are required.

LIU (Wei-t'ung) & ZIA (S. H.). **Studies on the Murine Origin of Typhus Epidemics in north China. I. Murine Typhus Rickettsia isolated from Body Lice in the Garments of a Sporadic Case.**—*Amer. J. trop. Med.* **21** no. 4 pp. 507–523, 2 figs., 51 refs. Baltimore, Md., 1941.

It has long been believed that typhus in northern China is of the historic or human type, but strains of the murine type have recently been isolated from the blood of patients and from rats and rat fleas in their surroundings [*cf. R.A.E.*, B **28** 129], and there is little doubt that both louse-borne and flea-borne typhus exist in this region. However, it is possible that even the louse-borne type may be derived from murine typhus. Most of the recent outbreaks of the disease have occurred in military camps, orphanages or poor-houses heavily infested

with rats and rat fleas and over-crowded with uncleanly, undernourished people infested with lice [*Pediculus humanus*, L.], so that circumstances were very favourable to the development of murine typhus into an epidemic form. This paper deals with observations on a strain of typhus obtained from an apparently isolated endemic case (a man who had been living at an inn infested with rats, mice and fleas) and a similar strain from lice collected in his garments. The disease was moderately severe, but not fatal. Both strains conformed in all their attributes in guineapigs, albino rats and mice to the murine type, except that there was little or no scrotal swelling in guineapigs. Evidence is adduced from previous observations by the authors and from the literature that murine strains do not always produce pronounced scrotal swellings in guineapigs, some of them appearing to be intermediary in orchitic property in these animals between the murine and the human rickettsiae or to resemble the latter. The present strains were therefore identified with the murine rickettsia. It is concluded that in northern China, as in Mexico [**20** 245], when persons infested with lice contract murine typhus, the body louse may become a carrier of the murine rickettsia, and in all probability epidemics, either large or small, may result if circumstances are favourable.

COGGESHALL (L. T.). **Infection of *Anopheles quadrimaculatus* with *Plasmodium cynomolgi*, a Monkey Malaria Parasite, and with *Plasmodium lophurae*, an Avian Malaria Parasite.**—*Amer. J. trop. Med.* **21** no. 4 pp. 525–530, 1 fig., 9 refs. Baltimore, Md., 1941.

In a search for mosquitos capable of transmitting experimental monkey malaria [*cf. R.A.E.*, B **19** 230], *Anopheles quadrimaculatus*, Say, was shown to be highly susceptible to infection with *Plasmodium cynomolgi*, which was isolated from *Macacus cynomolgus*. High percentages of the mosquitos developed intense infection after feeding on monkeys (*M. rhesus*) that had abundant gametocytes of *P. cynomolgi* in their blood, and they transmitted the infection to normal monkeys. Attempts to transfer *P. cynomolgi* to paretics by means of both infected blood and sporozoites were unsuccessful. Attempts to infect *A. quadrimaculatus*, *A. punctipennis*, Say, and *Culex pipiens*, L., with *P. knowlesi* by allowing them to feed on infected monkeys or on men with therapeutic, induced, *P. knowlesi* malaria were all negative. The latter observation seems to justify the conclusion that the host is not a determining factor in the susceptibility of a mosquito to a parasite. An attempt to infect *A. quadrimaculatus* with *P. inui* by feeding it on an infected monkey was also unsuccessful. When *A. quadrimaculatus* was fed on chicks infected with *P. lophurae* nearly half of them were positive for oöcysts, though infections were mild and no sporozoites were found [*cf.* **29** 194]. Very small percentages of *Culex pipiens* and *Aëdes aegypti*, L., similarly fed, became infected.

The fact that one species of Anopheline can become infected with three species of *Plasmodium* the hosts of which are man, monkey and bird, respectively, indicates that the relation between host and parasite is broader than is generally supposed. It is, moreover, clear that the natural association of vector and parasite is not necessary for susceptibility, because *A. quadrimaculatus* is confined to America, whereas *P. cynomolgi* originates from Java and *P. lophurae* from Borneo.

Russell (P. F.) & Mohan (B. N.). **Experimental Malaria Infections in *A. stephensi* from contrasting Sea-water and Tap-water Larva. Environments.**—*Amer. J. trop. Med.* **21** no. 4 pp. 553–558, 11 refs. Baltimore, Md., 1941.

In further experiments to test the theory that the chemical constitution of the water of the breeding place might so modify Anopheline larvae that the relation of the adults to *Plasmodium* was affected [*R.A.E.*, B **28** 44, 113], eight lots of females of *Anopheles stephensi*, List., each comprising a batch obtained from larvae reared in tap water and one from larvae from brackish water [*cf.* **24** 257] were allowed to feed on persons infected with *P. falciparum*. The brackish water comprised 50–80 per cent. sea water. The results of the dissection of each lot are shown in a table. All the mosquitos in the eighth lot were negative. In the other seven, the percentages of females infected and showing sporozoites were 33·9 and 27·1, respectively, in the tap-water series and 35·9 and 31·9 in the salt-water series. The sporozoite percentages in the fourth lot were 71·2 in the tap-water series and 81·6 in the salt-water series, which was bred in 50 per cent. sea water. A detailed analysis of the results in this lot is given, according to the day of dissection, which was 9–13 days after the infecting feed.

In random samples of larvae developing in the brackish water, a marked shortening of the anal gills was observed. If the larvae were removed to tap water, the gills returned to the normal size [*cf.* **21** 53, 74; **27** 37, 55].

Kumm (H. W.) & Ram (L. M.). **Observations on the *Anopheles* of British Honduras.**—*Amer. J. trop. Med.* **21** no. 4 pp. 559–566, 1 map, 9 refs. Baltimore, Md., 1941.

Following the discovery of *Anopheles darlingi*, Root, in British Honduras [*R.A.E.*, B **28** 198], a study was made between 26th July and 12th August 1940 of the part it plays in the transmission of malaria there. Eight species of *Anopheles* and one of *Chagasia* (*bathanus*, Dyar) have been found in the colony; a table shows their distribution in the 17 localities visited during this study and three examined previously. The most widely distributed species was *A. albimanus*, Wied; *A. darlingi* was restricted to inland rural areas in the Toledo and Stann Creek districts in the southern half of the colony. The distribution of these two species and *A. vestitipennis*, D. & K., which appears to be another important vector of malaria, is shown on a map. *A. darlingi* comprised 71·8 per cent. of the Anophelines caught in houses and 27·3 per cent. of those taken at sunset with a horse as bait in the areas where it was abundant. A moderately heavy gland infection was found in one of 24 females dissected from a little settlement in Toledo district, but the glands of 58 caught in houses in Stann Creek Valley were all negative, and oöcysts were found in only one of the 32 of these that were examined for stomach infection also. *A. vestitipennis* was not caught in houses in Toledo district, but it was abundant in a hamlet in Stann Creek Valley, where there were several cases of malaria; one gland infection and no gut infection was found among the 41 individuals dissected. Only two individuals of *A. albimanus* were dissected, and neither had gut or gland infection. Larvae of *A. darlingi* were obtained in six localities; four of the breeding places were in the shade and two exposed to the sun for part of the day. No

green algae were observed in any of them. The current was quite swift in two, slow in two and absent from two. One of the breeding places consisted of a number of flooded rain pools in the forest and contained débris, and another was the grassy edge of a large borrow pit full of dark brown water. A few larvae were found among roots and débris at the edges of a swiftly moving stream of clear water. The most prolific breeding place was a pond that had formed in a slowly running stream largely choked with grass ; the larvae and pupae were abundant among floating matter and roots at the shaded edge.

WIGGLESWORTH (V. B.). **Malaria in War.**—*Nature* **147** no. 3728 pp. 436–439, 8 refs. London, 1941.

Attention is drawn to the fluctuation of malaria in Europe through the centuries, the rise in the incidence of the disease there during the war of 1914–18 and the large number of service days lost by troops in various fighting zones during the same period. Malaria is then used to illustrate the practical value of pure biological research. The theories of malaria transmission as they are accepted to-day are summarised, the vectors in areas of present or prospective hostilities are given with their types of breeding place, and the situation with regard to the varieties of *Anopheles maculipennis*, Mg., is briefly set out, stress being everywhere laid on the practical application of academic detailed knowledge. The organisation and functions of the mobile malaria laboratories established by the army to deal with the matter are outlined, and prophylactic measures, the further investigation needed on them and the biological characters on which they are based are discussed with reference to the literature, particular attention being given to oils and shading.

MCCARTHY (D. D.). **Report of the Zanzibar Research Unit June 1934 to September 1937.**—Fol., ii+141 pp., 2 pls., 2 maps, 56 figs., 4 pp. refs. Zanzibar, 1941. Price 5*s*.

This report deals with a malaria survey carried out from June 1934 to September 1935 and from September 1936 to September 1937. Accounts of the history, topography, geology and economics of the Protectorate and descriptions of the different areas are included, and meteorological data, in so far as they affect malaria, are discussed. The various elements in the population and their mode of life are also briefly dealt with. Malaria is hyperendemic everywhere, but there is nevertheless an epidemic element that is most evident in Zanzibar town, where control measures are systematically performed, and along the dry eastern and southern coasts of Zanzibar island. Major cycles, apparently due to cyclical variations in the immunity of the population, increases in the virulence of the parasites or in the infectivity or numbers of the vector, or cyclical changes in the type of parasite concerned, and accompanied by heavy infant mortality, occur about every ten years, and minor cycles, related to local meteorological conditions, every three or four years. The latter, reflected most clearly in the splenic index, are probably due to relapses rather than to new infections.

The predominant parasite is *Plasmodium falciparum*, which is the earliest to appear and persists throughout life. *P. vivax* is usually found in young children, but occurs in persons of all ages during

years of very active transmission. There is evidence that major cycles are associated with prevalence of this species. Tolerance to it is developed comparatively quickly, but, without repeated reinfections, seems to disappear after a few years. The incidence of *P. malariae* is low but constant, and though most common in children, it may be found in persons of all ages. *P. ovale* was found in a few blood films. The gametocyte percentage and output per case in all species are highest in children; this suggests that when immune tolerance has been established, the parasite, being no longer imminently in danger of extinction, does not need to produce rapidly the sexual forms necessary for active transmission. Adults, however, because of their numerical superiority, are capable of infecting a considerable proportion of available Anophelines. The rapidly altering weather at the change of the monsoon in October–November and February–March leads to an increased production of gametocytes in adults; the increase in February–March is the more important as it occurs just before the principal rainy season and produces a high infectiveness when the Anopheline population is greatest.

Records are given of the Anophelines taken in Zanzibar town, the rural areas of Zanzibar and Pemba, and of their breeding places. Sporozoite infection in the females was estimated by gland dissections, usually made on the day after the mosquitos were caught; stomachs were not examined. *Anopheles gambiae*, Giles, is the major vector throughout the Protectorate, and almost the only one in Zanzibar town and probably in the villages of the east and south of Zanzibar island. In the centre, where lagoons and swamps occur, it forms about half of the Anopheline population, whereas in the north-east, where streams form the bulk of the surface water, its density is much lower and definitely seasonal. It breeds in a great variety of situations [*R.A.E.*, B **16** 91], requiring only exposure to the sun, still or very slowly moving water, and an absence of heavy pollution. The larvae can withstand a considerable degree of salinity, and grew and pupated in water of which 25 per cent. was sea water. There are no breeding places of note in the town; careful examination failed to produce evidence that breeding could occur in tanks or cisterns. Breeding places on the outskirts produce *A. gambiae* and *A. funestus*, Giles, in almost equal numbers, the latter slightly predominating, but the former is the only one to invade the town for more than half a mile. Infectivity increased with distance from the breeding places and was in inverse ratio to infestation. In the town and centre and south-eastern districts of Zanzibar, *A. gambiae* comprised 15,806 of the 29,558 Anophelines caught in houses. In the north-western district of Zanzibar and in Pemba, it comprised only 2,760 of the 6,979 Anophelines taken. In 8,037 dissections, 4·55 per cent. were positive for sporozoites, with a variation from 1 to 13 per cent. according to locality, season and year.

A. funestus is the dominant species in Pemba and the area to the west and north of the central ridge in Zanzibar, though being less aggressive and less robust than *A. gambiae*, it is the less important vector. It appears to be represented chiefly by the typical form. It is complementary to *A. gambiae* in seasonal occurrence. Of 6,619 dissections, 3·44 per cent. showed sporozoites. The rate varied little in different areas, except in the north of Zanzibar island, where it was only 1·75 per cent. The greatest numbers of Anophelines were taken in houses between 11 p.m. and midnight. A few left the houses before

morning. After 3 a.m. most were found resting, usually on hangings and in occupied rooms. Of the five other species found, *A. maculipalpis*, Giles, *A. coustani*, Lav., and *A. marshalli*, Theo., were taken in numbers as larvae, but *A. squamosus*, Theo., was not. *A. marshalli* and *A. rufipes*, Gough, which was the least common species, were found in the Protectorate for the first time. Adults of *A. maculipalpis* were very seldom met with, and their presence in houses was obviously accidental. *A. coustani* and *A. squamosus*, Theo., were rare in buildings, and of the few individuals of these two species dissected, none showed sporozoites. Adults of *A. marshalli* were not infrequently taken and many were dissected, but again the results were negative. Keys are given to the larvae and adults of these seven species.

Control measures are at present confined to the reduction of Anophelines and the protection of the non-immune population by such means as mosquito nets and the proofing of houses. The cheapest method of controlling larvae in the pools that form in the town after excessively heavy rain is the use of Paris green or oil. Where the situation is complicated by erosion, turfing is suggested, and other methods recommended include the filling in of many shallow wells rendered superfluous by the extension of the town water supply, and the construction of a dam across the upper reaches of a stream running along the north boundary, with a gate through which the water could be released every few days to flush the stream. The removal of vegetable gardens from the marshy areas round the head waters of streams to a higher position and afforestation of the areas with eucalyptus is considered desirable, but impracticable. Keeping the plots clear of vegetation during the winter would reduce breeding to some extent. The non-immune population of Pemba is chiefly in the three townships and is too small to warrant large expenditure. Control is at present limited largely to treatment of small breeding places within the townships with oil or Paris green, while most Anophelines come from without. The clearing of the trees surrounding the townships would be a considerable improvement, but is difficult for economic reasons. The experimental construction of a central open channel and subsoil drains appears to be drying one marshy valley extremely well, and others could be dealt with similarly. Silting has prevented the flooding of a large semi-salt marsh by every high tide, but it is thought that the level will gradually rise enough for the area to drain into the existent central channel. A portion of it is being experimentally drained with open concrete drains. The difficulty of dealing with the rural area, where the population is very scattered and almost entirely immune, is discussed.

RICHARDS jr. (A. G.). **A Stenogamic Autogenous Strain of *Culex pipiens* L. in North America (Diptera : Culicidae).**—*Ent. News* **52** no. 8 pp. 211–216, 19 refs. Philadelphia, Pa., 1941.

It has been found that genetically distinct strains of *Culex pipiens*, L., similar to those observed in Europe [*R.A.E.*, B **21** 266 ; **24** 98, etc.] occur in the eastern United States. A strain that apparently established itself in the vivarium of the laboratory of the University of Pennsylvania some years ago maintains itself there by breeding throughout the year. It is autogenous, stenogamic and homodynamic. Another strain present in the eastern United States usually requires a blood meal before it can breed and is eurygamic ; there are no data

as to whether or not it is heterodynamic. On one occasion, three successive generations of the laboratory strain were obtained in small covered aquaria without special feeding for adults or larvae or renewal of the water, and on three others, one generation was bred. The number of eggs per raft was rather low, and oviposition did not take place until 5–8 days after emergence. In the vivarium also, the egg rafts were small; and, though females flew about in large numbers, no individual obviously engorged with blood was seen, and, except in the summer when mosquitos were coming in from outside, only one report was made of an attempt to bite. Not all the females under observation laid eggs, and in one of the six instances some of the egg rafts were not viable. Pairing was observed in a jar with a capacity of 200 cu. ins., and viable eggs were produced in one with a capacity of 115 cu. ins. There is no seasonal interruption in development in the moderately heated vivarium. In an unheated room, adults continue to be active until ice is present out-of-doors, and larvae to develop in spite of some ice in the aquaria each night; pupation occurs on warmer days. As the winter temperature of the room is too low for adult activity, there is only one brood of larvae after ice appears at night. The strain was not phototropic in the laboratory, and H. B. Weiss tested 64 adults and found that all failed to react positively or negatively to light of various wave-lengths.

On Long Island, larvae of *C. pipiens* are sometimes found in water with ice in it, and there are occasional reports of winter activity, one series of adults taken in February 1941 comprising about 50 per cent. males. Light-traps usually produced satisfactory samples, but in certain areas where the adults were fairly common near the traps, none was taken in them.

The literature on the nature of these different characteristics is briefly reviewed, and it is pointed out that the situation in the United States differs from that in England, as the American autogenous strain does not agree in structural characters with the description of *C. pipiens molestus*, Forsk., as given by Marshall & Staley [**25** 136; *cf.* also **27** 54]. The American anautogenous strain does not shun human blood.

MAILEN (T. H.). **Seasonal Occurrence and the Effect of Host Attractiveness on the Abundance of Stable Flies and Horn Flies on Cattle.** —*Proc. Okla Acad. Sci.* **21** pp. 19–21, 1 graph. Guthrie, Okla., 1941.

In field tests of fly-sprays against *Stomoxys calcitrans*, L., and *Lyperosia irritans*, L. (*Haematobia serrata*, R.-D.) on cattle carried out at Stillwater, Oklahoma, from 11th June to 13th September 1940, fly-counts were made at intervals of half an hour from 8 a.m. to 2 p.m. on cattle staked 50 ft. apart, and the average number of each species of fly per animal for each day of observation and the mean temperature and rainfall are shown in a graph. The greatest abundance of both species occurred on 11th June, but in contrast to *Stomoxys*, *Lyperosia* was again very numerous on various subsequent dates. The total numbers of each species of fly counted on each of 14 unsprayed animals during a five-day period in late July are shown in a table. The numbers of *Stomoxys* per animal varied from 347 to 666 and averaged 507, and the corresponding figures for *Lyperosia* were 276, 5,566 and

2,645. It was evident that the variation in attractiveness of different individuals is so great that it would be impossible to use unsprayed animals as controls in tests of fly-sprays.

ROBERTS (F. H. S.). **The Distribution of the Sheep Body Louse,** *Bovicola ovis*, **in Queensland.**—*Qd agric. J.* **55** pt. 2 pp. 108–109, 1 map. Brisbane, 1941.

Only two species of louse, *Bovicola ovis*, L., and *Linognathus pedalis*, Osb., are known to infest sheep in Queensland. Of these, *B. ovis* is much the more important, as *L. pedalis*, though it has a wider distribution, extending far to the west, occurs only in more or less isolated localities. The area permanently infested by *B. ovis* is shown on a map. Infestation is densest in the east of the sheep-rearing area, particularly in the Darling Downs.

ROBERTS (F. H. S.). **The Scrub Tick** (*Ixodes holocyclus*).—*Qd agric. J.* **55** pt. 3 pp. 189–192, 2 figs. Brisbane, 1941.

An account is given of the morphology, life-cycle [*R.A.E.*, B **13** 28] and distribution in Queensland of *Ixodes holocyclus*, Neum., and its importance in causing tick paralysis [**15** 32], to which foals, calves, sheep and dogs appear particularly susceptible. Measures for the protection of dogs are given [**23** 159], with brief notes on the treatment of tick paralysis in them by the use of an immune serum, which is very effective. The serum treatment of foals and calves is not so successful, and it is recommended that these animals should be sprayed every 7 days during the tick season with the wash of derris and soap used for dogs [*cf.* **23** 159], and that the inside of the ears and parts round the eyes should be carefully examined and any ticks removed. Pastures should be cleared of scrub and undergrowth likely to shelter the native marsupial hosts of the tick and, if possible, fenced to exclude them.

COLAS-BELCOUR (J.). **Sur l'importance numérique de la ponte de l'ornithodore hispano-africain,** *Ornithodorus erraticus* **Lucas.**—*C. R. Soc. Biol.* **134** no. 8 pp. 544–545, 8 refs. Paris, 1940. [Recd. 1942.]

The scanty data on the number of eggs laid by Argasid ticks, which are difficult to obtain because, unlike Ixodids, the females oviposit several times, are summarised. They comprise those already noticed [*R.A.E.*, B **1** 115; **10** 139; **13** 48; **25** 122] and a record of the laying of 1,158 eggs in 7 batches by *Ornithodoros coriaceus*, Koch. In observations made by the author on a Tunisian strain of *O. erraticus*, Lucas, 5 females of medium size kept in the presence of males in individual tubes at a constant temperature of 28°C. [82·4°F.] and a relative humidity of 90 per cent., and fed on guineapig, laid 1,137, 918, 936, 1,136 and 931 eggs in 6, 7, 9, 9 and 8 batches, respectively, and 4 smaller females kept in the same conditions laid 626, 609, 391 and 616 eggs in 8, 7, 5 and 8 batches. The position of the largest batch in the series was irregular; it was often the second or last but one, occasionally the last, but never the first [*cf.* **13** 48]. The proportion of viable eggs in the batches decreased as the female grew older. Though the number of eggs laid is smaller than that laid by most Ixodids, numerical inferiority is counterbalanced by their division into numerous batches, as the eggs, by being laid at different times, have a greater chance of survival.

BATES (M.). **Field Studies of the Anopheline Mosquitoes of Albania.**—*Proc. ent. Soc. Wash.* **43** no. 3 pp. 37–58, 7 figs., 15 refs. Washington, D.C., 1941.

Field observations on the Anophelines of Albania [*cf. R.A.E.*, B **28** 88], made between 1936 and 1939 in connection with the programme of the laboratory for mosquito research in Tirana [**28** 84], are summarised. Those found comprised *Anopheles algeriensis*, Theo., *A. claviger*, Mg., *A. hyrcanus* Pall. (possibly subsp. *pseudopictus*, Grassi), *A. marteri*, Senevet & Prunelle, *A. plumbeus*, Steph., *A. superpictus*, Grassi, and four members of the group of *A. maculipennis*, Mg. (vars. *messeae*, Flni., *sacharovi*, Favr, *subalpinus*, Hackett & Lewis, and *typicus*) for which the author adopts the nomenclature he proposed in a recent paper [**29** 41]. Brief notes are given on their local distribution and also keys for the identification of the eggs and fourth-instar larvae. The larvae of the *maculipennis* group can in most cases be identified by means of the variation in the antepalmate hairs [*cf.* **28** 96], and a table is given to show how this method of identification is applied to field material.

As in Greek Macedonia [**23** 296], intense malaria in Albania is associated with *Anopheles maculipennis* var. *sacharovi*, but the disease also occurs in areas where this form is not found, and it then appears to be carried by *A. superpictus*. It is also found in a few places, notably on the shores of Lake Malik, where the only common mosquitos are *A. maculipennis* vars. *typicus*, *messeae* and *subalpinus*, which are generally supposed not to be vectors because they do not readily attack man. The villages are very near the lake where the mosquitos breed in immense numbers.

Larval habitats were studied in detail only for the members of the *maculipennis* group. Of these, var. *subalpinus*, which occurred all over the country but bred only in marshes and ponds, had the most limited habitat. It was never found in heavily shaded situations, in water with a small surface area, high nitrate content or appreciable salinity or in water free from vegetation or subject to strong surface movements. The limitations of var. *messeae* were similar, and moreover, its geographical range in Albania is very limited, possibly because of the effect of the maximum summer temperature on the adults. Var. *sacharovi*, though typically a marsh breeder, was found in small bodies of water, such as pools and ditches, and in water containing slightly more than 2 per cent. sodium chloride, but is subject to the other limitations. The geographical range of this form also is limited, possibly through the effect of minimum winter temperatures on the adult. Var. *typicus* was found all over Albania in a wide range of habitats, but in general the limitations were the same as those for *subalpinus* except for that of area of water surface. *A. superpictus*, which breeds typically in the small pools in gravelly river beds, is thus not subject to the limitations of vegetation and surface movement. Late in the season, when the adult population has reached its maximum, the eggs may sometimes be found in very varied habitats, including small pools and rice-fields. *A. hyrcanus* and *A. algeriensis* were most abundant in a large marsh. Larvae of *A. plumbeus* were found only in tree holes, In the summer, *A. claviger* was found only in shaded spring-fed pools. but in the winter and early spring, it occurred in many types of habitat. The pools in mountain streams in which *A. marteri* bred were characterised by heavy shade, low temperature and clear fresh water. The

field study of the eggs was found to be the most useful way of defining the breeding places of the various members of the *maculipennis* group. The author believes, therefore, that the ecological distribution of Anophelines depends on selection of the oviposition site by the female [*cf.* **28** 231].

The seasonal distribution of adults of var. *typicus* as previously determined [**25** 288] was compared with larval distribution. The decline in the numbers of adults during July was first attributed to the fact that many of the breeding places near Tirana, where the survey was made, dry up at this time. However, when in 1937 a small permanent stream was dammed to form a shallow pool that could be kept at a constant level throughout the summer, the larval population in the pool declined at a similar rate to the adult population, beginning slightly earlier, and there was no great increase in the number of first-instar larvae after the peak in the adult population. These results were thought to indicate that the drop in population is largely due to a high mortality of adults, probably on account of high temperature and low humidity. In each of the years 1933–37, the peak of the population preceded the peak in mean temperature. The technique used for counting the larvae is described.

Data on the relative numbers of larvae in different instars were collected for various breeding places and seasons on the theory that the ratio between instars might be fairly constant during the period of continuous breeding and that variation in it might throw light on seasonal changes of population. Ratios are given for larvae from five breeding places of var. *typicus* in Albania, in two of which vars. *messeae* and *subalpinus* also occurred, and for var. *atroparvus*, van Thiel, in Portugal according to Cambournac [**27** 233]. The ratio in var. *typicus* varied considerably from one breeding place to another and would even appear to be more useful as an index of differences between breeding places than in the study of seasonal variation. On the basis of observations on the duration of the various instars of var. *atroparvus* when reared in a favourable medium, which are discussed, the percentage of larvae in the four instars in an area of continuous breeding with no mortality should be 16, 20, 24 and 40, respectively. In the natural breeding places, these ratios were, with one exception, more or less reversed, the greatest number of larvae being in the first instar, and this suggests an interesting approach to some of the problems of larval ecology.

Entomological Investigations.—*Rep. Coun. sci. industr. Res. Aust.* **14** (1939–40) pp. 16–24. Canberra [1941]. **Animal Health and Nutrition Investigations.**—*T.c.* pp. 25–41.

A considerable part of the work carried out in Australia by the Divisions of Economic Entomology and of Animal Health and Nutrition during the year 1939–40 dealt with sheep blowflies [*cf. R.A.E.*, B **29** 51]. *Lucilia cuprina*, Wied., was the only species involved in 77 per cent. of the strikes in the experimental flock and was present in, and probably the initial cause of, 96 per cent. The total strike incidence in the flock was 75 per cent., and pure tail strikes comprised 17 per cent. of the total. In observations on the effect of Mules' operation [*cf.* **29** 143], a treated group produced an average of 5 oz. more greasy wool per head than the controls as a result of the lower incidence of strike. A three-year study of a group of ewes from which the breech fold had

been removed on the left side only, showed that the effect of the operation is permanent in most cases, and the earlier it is performed the better. A definite reduction of strike on the left side occurred. Preliminary tests with an American repellent and lethal fly spray containing butyl mesityl-oxide-oxalate [*cf.* **27** 251] suggested that the repellent effect to ovipositing females of *L. cuprina* is initially of the same order as that of citronella oil [*cf.* **29** 50], but that it is somewhat more lasting. Each of seven constituents of citronella oil was less repellent than the oil itself.

Investigations on the physiology of larvae of *L. cuprina* included further studies of the absorption, accumulation and elimination of copper, iron and barium. The epithelial cells of the acid midgut [**29** 52, 104] form a mosaic in which the accumulation of certain metallic ions takes place. Iron and copper can be accumulated by larvae in sufficient quantity for them to reach maturity on media poor in these elements. Iron is apparently not absorbed from the food after the midgut band of cells reaches saturation point; the toxic level for iron in the medium is, therefore, extremely high. The concentration of copper in larvae is, however, almost directly proportional to the concentration in the medium. On a diet rich in protein, the larvae can reach maturity in the presence of concentrations of copper equivalent to 1 per cent. copper sulphate. The contact toxicity of copper solutions is also low. It seems unlikely, therefore, that copper will prove an effective larvicide for this species. The enriched medium [**28** 57] seldom permitted more than 50 per cent. emergence of adults, whereas 95 per cent. of larvae fed on liver gave rise to adults. The addition of a concentrated, though impure, extract of vitamin A in fish oil increased the rate of larval growth and percentage pupation and raised the percentage adult emergence to 80 or more. Larvae were fully grown after 1–1½ days. The thermal death point of larvae of *L. cuprina* immersed in water for 10 minutes was 47·5°C. [117·5°F.].

As war conditions have increased the price of and difficulty of procuring certain ingredients of a dressing recently recommended for infested sheep [**28** 103], preliminary experiments were made with a solution of sodium pentaborate. A solution containing the equivalent of about 20 per cent. of boric acid in water is easily prepared and highly effective in killing the blowfly larvae. It is non-irritant and does not rapidly drive the larvae from the dressed area. They are killed after several hours. Observations on routine classing of sheep tended to show that culling reduces the susceptibility of a flock even when it is carried out without regard to strike.

Preliminary studies in Europe and the United States on the life-history and habits of *Scatophaga stercoraria*, L., a general predator on the larvae of Muscids, suggest that it is unlikely to be of use for the control of *Lyperosia exigua*, de Meij. Experiments carried out during the year showed that *Echidnophaga myrmecobii*, Roths., and various mosquitos can transmit myxomatosis from infected to healthy rabbits under laboratory conditions [*cf.* **29** 110]. Attempts to establish the flea on rabbits at Wardang Island failed because the environment was unsuitable for it.

In observations on the life-history of the sheep ked [*Melophagus ovinus*, L.] [*cf.* **29** 52], the female was found to be able to pair a few hours after emergence but did not deposit the first pupa for 14 days or more. Thereafter, pupae were deposited at the rate of about one per week. If pairing was deferred until the third day after emergence,

the first pupa was still deposited about the 14th day of adult life. The evidence suggests that the males require about 10 days to become sexually mature, so that if newly emerged males and females are put together, the first pupae do not appear for at least 18 days or generally longer. These are important points in relation to dipping practice. The pupal period usually lasts 19–22 days, but sometimes extends to 26 and in one experiment was 32 days. It is thought that males and females seldom live more than 80 and 100–120 days, respectively. In an attempt to discover why many keds disappear from experimentally infested sheep, it was found that a few drop off either by accident or design and a few die and fall from the fleece or become entangled in the wool, while there is evidence that sheep destroy some by biting at the irritated part. The females tend to wander towards the belly and crutch for the first fortnight and then forward to the shoulder, brisket and neck, where most pupae are deposited. Pupae are never deposited less than about ¼ inch from the skin, and as the wool grows they are deposited further from it. The extent to which keds will survive and multiply on a sheep depends greatly on the animal's bodily condition. Sheep with internal parasites were particularly susceptible. Keds were not usually kept alive for more than five days off the sheep, but, at a constant temperature of 4°C. [39·2°F.] and 90 per cent. relative humidity, 11 out of 18 survived for 15 days and one until the 24th day. Research on dipping showed that sheep carrying 10–12 weeks' wool remove 1½–2 gals. fluid on emerging from the dip, about half of which drains away. About 95 per cent. of the fluid draining from dipped sheep leaves them in seven minutes, and 75 per cent. within one minute. When soluble arsenicals were used in the dips, the arsenic content of the liquid draining from the sheep was about the same as that of the dip, though the later drainings after dipping in sodium arsenite and sodium arsenate had a slightly higher arsenic content. Suspensions of insoluble arsenic trisulphide gave draining fluids with only half the arsenic content of the original dip, so that the drainings would dilute the main fluid if allowed to flow back into it. The passage of sheep through a suspension of insoluble arsenicals stabilises the suspension, probably because of the suint and wax. When *Melophagus* pupae of mixed ages were immersed in solutions of sodium arsenite, phenol, rotenone and a commercial arsenical powder dip used at the strengths generally prescribed, none of these agents materially affected the percentage emergence, but in a subsidiary trial in which sodium arsenite and the commercial dip were used, both were effective against pupae one day old.

PAPERS NOTICED BY TITLE ONLY.

FRINGS (H.). **The Loci of olfactory End-organs in the Blowfly,** *Cynomyia cadaverina* **Desvoidy.**—*J. exp. Zool.* **88** no. 1 pp. 65–93, 1 fig., 34 refs. Philadelphia, Pa., 1941.

VARGAS (L.). *Aëdes* (*Ochlerotatus*) *rozeboomi* **nueva especie** [from the State of Campeche, Mexico] (**Dipt. Culicidae**).—*Gac. méd. Méx.* **71** no. 3 pp. 393–395, 8 refs. Mexico, D.F., 1941.

BELTRAN (E.). **Estado actual de nuestros conocimientos acerca del** *Plasmodium gallinaceum* **Brumpt, 1935.** [The present State of Knowledge of *P. gallinaceum* (a review of the literature).]—*Rev. Inst. Salub. Enferm. trop.* **2** no. 1 pp. 95–113, 3½ pp. refs. Mexico, D.F., 1941. (With a Summary in English.)

MARTINS (A. V.). **Infecção experimental do "*Triatoma arthurneivai*" Lent e Martins, 1940, pelo** *Schizotrypanum cruzi*. [The experimental Infection of *T. arthurneivai* by *Trypanosoma cruzi*.]—*Brasil-medico* **55** no. 9 p. 131, 2 refs. Rio de Janeiro, 1941.

Triatoma arthurneivai, Lent & Martins, which was recently described from the State of Minas Gerais, Brazil [*R.A.E.*, B **29** 154], has not been taken in dwellings and probably feeds on field rodents and on other Arthropods, chiefly Blattids of the genus *Monastria*. In the laboratory it also fed on guineapig and pigeon and on man. None of 19 nymphs in different stages of development was found naturally infected with *Trypanosoma* (*Schizotrypanum*) *cruzi*, but six nymphs allowed to feed on a carrier of Chagas' disease all became strongly infected with the trypanosome.

WHEELER (C. M.) & DOUGLAS (J. R.). **Transmission Studies of Sylvatic Plague.**—*Proc. Soc. exp. Biol. Med.* **47** no. 1 pp. 65–66. New York, N.Y., 1941.

In mass feeding experiments with *Ceratophyllus* (*Diamanus*) *montanus*, Baker, and *Hoplopsyllus anomalus*, Baker, the predominant fleas on *Citellus beecheyi* in California, *C.* (*Malareus*) *telchinum*, Roths., from *Microtus californicus*, the rat fleas, *C.* (*Nosopsyllus*) *fasciatus*, Bosc, and *Xenopsylla cheopis*, Roths., and the cat flea, *Ctenocephalides felis*, Bch., plague was transmitted by each species except *Ceratophyllus telchinum*, and *H. anomalus* appeared to be a poor vector. The infection, vector and transmission potentials of each species were then determined by individual feeding experiments on white mice. The infection potential is obtained by dividing the number of fleas that become infected (ascertained by daily faecal cultures during the life of each flea and subsequent histological examination) by the total number used, and the vector potential by dividing the number of infected fleas by the number that transmit the infection ; the transmission potential is the number of transmissions (infected mice) per infective flea. The product of these factors represents the number of transmissions effected by an average individual or the vector efficiency. The results are given for *Ceratophyllus montanus* and *X. cheopis* ; the three potentials and vector efficiency were 0·85, 0·52, 2·58 and 1·14, respectively, for the former, and 0·98, 0·29, 1·44 and 0·39 for the latter. These figures show that to evaluate the efficiency of an Arthropod as the vector of an infectious agent, all three potentials must be taken into account.

STEWART (M. A.) & EVANS (F. C.). **A comparative Study of Rodent and Burrow Flea Populations.**—*Proc. Soc. exp. Biol. Med.* **47** no. 1 pp. 140–142, 2 graphs. New York, N.Y., 1941.

An investigation was carried out in a district of California heavily populated with *Citellus beecheyi* on the correlation between flea populations on the ground squirrels and at the openings of their burrows and on the seasonal composition of these populations. Cotton batting was placed in the mouths of 30 burrows, divided into three approximately similar groups of 10, and collections were made at weekly intervals from 29th April to 23rd October 1940 from the three groups

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in rotation, while ground squirrels were trapped alive, lightly anaesthetised and combed to remove all fleas at similar intervals over the same period. All but about a dozen of the 7,500 fleas taken were *Ceratophyllus* (*Diamanus*) *montanus*, Baker, or *Hoplopsyllus anomalus*, Baker. *C. montanus* was markedly predominant in the flea population from 29th April to 28th June when the mean temperature was below 75°F. and *H. anomalus* from 11th July to 14th October when the mean temperature was above 75°F. No other correlation between atmospheric or burrow temperatures and flea indices was detected. The density of the flea population and its composition at the mouths of the burrows, as shown by the figures for groups of 10 openings, reflect with a high degree of accuracy, though on a smaller scale, the flea indices of the host. It should, therefore, be possible by flea surveys from 10 or more burrow mouths to obtain information as to the appropriate time to begin prophylactic measures against sylvatic plague, the plague potentialities of an area based upon the species of fleas in it and, presumably, the presence or absence of plague infections in the flea population and the likelihood of epizootics. Although *H. anomalus* can transmit plague under experimental conditions, it is probably not so efficient a vector as *C. montanus* [*cf.* preceding abstract]. It is possible that in the past, areas have been recorded as free from plague infection because they were surveyed at a time when the predominant flea species were poor vectors or incapable of transmitting plague.

Ackert (J. E.), Boles (H. P.) & Grundmann (A. W.). **Oriental Rat Flea established in Kansas.**—*Science* **93** no. 2424 pp. 566–567, 4 refs. New York, N.Y., 1941.

Xenopsylla cheopis, Roths., was found on rats at the city dumping ground at Manhattan (Kansas) in September 1940 and again in April 1941, when the four rats taken harboured 2–8 examples each. It is thus evident that this flea can overwinter at Manhattan and is established there [*cf. R.A.E.*, B **29** 135].

Macchiavello (A.). **Investigaciones sobre peste en el nordeste brasileño.** [Investigations on Plague in north-eastern Brazil.]—*Bol. Ofic. sanit. pan-amer.* **20** no. 5 pp. 441–466, 1 ref. Washington, D.C., 1941. (With a Summary in English.)

Following its introduction into Santos in 1899, plague in man quickly spread to the other large ports of Brazil and to the cities of the north-eastern hinterland, but it now shows a tendency to disappear from the urban centres in favour of rural districts, where its appearance is so sporadic as to give the impression that it is endemic. Its epidemiology was studied in several north-eastern rural areas from August 1939 to September 1940, and also the relation to it of certain murine and feline epizootics not due to plague.

The rodents found included *Mus* (*Rattus*) *rattus*, which is domestic and is the most important source of plague in man, *M.* (*R.*) *r. alexandrinus*, which lives as a field rat, and *M.* (*R.*) *norvegicus*, which was unimportant. *Xenopsylla cheopis*, Roths., and *X. brasiliensis*, Baker,

were common on the first two, while *Pulex irritans*, L., was less numerous and *Echidnophaga gallinacea*, Westw., rare. Fleas were not common on field rodents. *X. cheopis* is the principal vector of plague in the region and was the only flea found infected with it. The existence of true sylvatic plague (primary plague among wild rodents) was not demonstrated. It was observed that in some areas the high external temperatures, which often exceed 36°C. (96·8°F.), prevent *X. cheopis* from living outside the nests of its rat hosts, in which the temperature is 5–8°C. (9–14·4°F.) lower, and in these circumstances there is a slow and prolonged subterranean epizootic with very few human cases. If the temperature falls, as it does with the onset of the rains, the fleas remain on the rats when they leave the nests, and plague appears shortly after in man, chiefly in individuals working near the nests of rats or whose beds are close to walls in which rats' nests are. The disease may also be transmitted to wild rodents, possibly through the intermediary of the opossum, *Monodelphis domesticus*, and certain field mice. It has been observed that the flea and *cheopis* indices of field rats rise in cooler weather, and *X. cheopis* has been taken on wild rodents at such times. This plague among wild rodents has little or no human repercussion.

Infected fleas remain in the rats' nests after most of the rats have died and the survivors have become immune, but the virulence of the plague bacilli in them becomes rapidly attenuated and is lost in a few weeks, apparently owing to tropical conditions [*cf. R.A.E.*, B **22** 220–221]. The author considers, however, that they may persist in the fleas for months and recover their virulence as a result of transmission to susceptible animals. The disease does not die out in the nests, because susceptible rats appear, as a result of breeding or migration. The attenuation of virulence of the bacilli explains the mild form of the disease that is observed in man towards the end of epidemics and epizootics.

Plague epizootics among rodents are sometimes accompanied by epizootics of other diseases, the causal organisms of some of which are listed and discussed. When a non-plague epizootic attacks a plague-infected rat community, there is a rapid increase in rat mortality, an increase in the flea index of the survivors and an increase in the incidence of plague in man. This is followed by a sharp decrease in the rat population, ending in its virtual extinction, and in plague in man. The surviving infected fleas may cause a few human cases after the end of the epizootic, but in general, plague does not reappear in man for some 3–5 years.

GAPUZ (R. B.). **Derris Infusion as a Poultry Dip for Louse Eradication.** —*Philipp. J. Anim. Industr.* **7** no. 2 pp. 153–161, 2 pls. 1940. (Abstr. in *Exp. Sta. Rec.* **84** no. 4 p. 500. Washington, D.C., 1941.)

Infusions of crushed fresh roots of *Derris philippinensis* in water in the proportion of 1 : 100 or stronger were found to be effective against all kinds of lice on fowls. In view of the variation in the toxic constituents of derris roots, it is recommended that concentrations of at least 2 per cent. should be used. Concentrations as high as 5 per cent. caused no injury to the fowls.

ROBINSON (W.). **Ammonium Bicarbonate secreted by Surgical Maggots stimulates Healing in purulent Wounds.**—*Amer. J. Surg.* (N. S.) **47** no. 1 pp. 111–155. 1940. (Abstr. in *Exp. Sta. Rec.* **84** no. 4 p. 524. Washington, D.C., 1941.)

Ammonium bicarbonate, which was shown to be present in comparatively large quantities in the secretions of larvae of *Phormia regina*, Mg., was found to possess marked healing properties similar to those of allantoin [*R.A.E.*, B **23** 305] and urea [**25** 159]. Its occurrence in the secretions is associated with the presence of the enzyme urease [**27** 199] in the tissues of the maggots. It is inexpensive and easily prepared for use in solution form. It was applied to purulent wounds as a 1 or 2 per cent. sterile solution on gauze packs.

REFUERZO (P. G.). **Arthropod intermediate Hosts of *Acuaria hamulosa* in the Philippines, I.**—*Natural appl. Sci. Bull., Univ. Philipp.* **7** no. 4 pp. 407–414, 3 figs. 1940. (Abstr. in *Exp. Sta. Rec.* **84** no. 4 p. 533. Washington, D.C., 1941.)

Aiolopus tamulus, F., and *Oxya sinensis*, Wlk., were found to act as intermediate hosts of *Acuaria* (*Cheilospirura*) *hamulosa* in the Philippines, where this worm sometimes infested as many as 20 per cent. of the fowls examined. Larvae from 18 to 20 days old parasitised fowls that were fed on infested grasshoppers, and eggs were recovered from the droppings 85–96 days later.

DE JESUS (Z.) & GAPUZ (R. B.). **Rotenone in low Concentration as a Tickicide and Insecticide for House Pets.**—*Philipp. J. Anim. Industr.* **7** no. 4 pp. 391–395. 1940. (Abstr. in *Exp. Sta. Rec.* **84** no. 5 p. 655. Washington, D.C., 1941.)

A dust containing 1–2 per cent. rotenone with cassava starch as the carrier was found to kill ticks and insects on dogs and cats without injuring the latter. The brown dog tick [*Rhipicephalus sanguineus*, Latr.] and a species of *Dermacentor* were killed in 24–72 hours, drying up while remaining attached to the skin.

VIADO (G. B.). **Some internal Effects of Dinitrophenols on Insects.** [Abstract.]—*Iowa St. Coll. J. Sci.* **16** no. 1 pp. 146–147. Ames, Iowa, 1941.

The laboratory investigations here summarised were carried out to elucidate the mode of action on insects of 3,5-dinitro-o-cresol and 2,4-dinitro-6-cyclohexylphenol. They showed that the latter had no decided effect on the haemolymph cells of 3-day-old larvae of *Cynomyia cadaverina*, R.-D., that ingested it with their food. The action of the other compound on the haemolymph cells was not studied. The first visible indication of a major effect of the poisons on adults of *Periplaneta americana*, L., dusted with them was paralysis. The behaviour of the larvae of both *C. cadaverina* and *Musca domestica*, L., and the nature of the tracheae in the antennae of the cockroaches treated with the poisons indicated that something besides nerve poisoning might be concerned. Both compounds were repellent to the larvae of the flies. The dinitro-cresol was more toxic to the insects than was the dinitro-cyclohexylphenol. When solutions of the ammonium and sodium salts of both compounds were ingested they were toxic, indicating that they were stomach poisons.

SULLIVAN (W. N.), GOODHUE (L. D.) & FALES (J. H.). **The Use of Fatty Acids in Insecticidal Aerosols.**—*Science* **94** no. 2445 pp. 444–445, 2 refs. New York, N.Y., 1941.

It has been shown [*R.A.E.*, B **28** 239] that an aerosol that is effective as a fumigant against insects and persists for a long time in an enclosed space can be produced by spraying solutions of relatively non-volatile insecticides from an atomiser on to a hot plate. The effect of the high vapour concentration obtained is increased by the contact action of the minute particles of insecticide suspended in the air. In an attempt to stabilise and increase the toxicity of the aerosols, fatty acids (lauric or oleic) were added to the spray solution. Tests against house-flies [*Musca domestica*, L.] showed that these materials increased the effectiveness of orthodichlorobenzene as did certain fatty acid derivatives such as salts and esters. When orthodichlorobenzene and the fatty acids were used at rates of 0·28 cc. and 0·071 gm. per cu. ft., respectively, the percentages of the flies dead after two days were 2, 55 and 60 for orthodichlorobenzene alone, with oleic acid and with lauric acid, and 1 for either acid alone. In room tests against cockroaches [*Periplaneta americana*, L.] and bed-bugs [*Cimex lectularius*, L.], 100 per cent. mortality was obtained by using 1·5 lb. orthodichlorobenzene containing 5 per cent. lauric acid per 1,000 cu. ft.

TELFORD (H. S.) & WESTER (C.). *Anopheles maculipennis* **Meigen and** *Anopheles punctipennis* **Say from North Dakota.**—*Science* **94** no. 2448 p. 514. New York, N.Y., 1941.

Adults of *Anopheles maculipennis*, Mg., and *A. punctipennnis*, Say, were taken in North Dakota in September 1941. Both species were already known to occur in the surrounding States and in Manitoba.

WHEELER (C. M.), DOUGLAS (J. R.) & EVANS (F. C.). **The Role of the Burrowing Owl and the Sticktight Flea in the Spread of Plague.**—*Science* **94** no. 2450 pp. 560–561, 5 refs. New York, N.Y., 1941.

A study was made during the spring and summer of 1941 of a plague epizootic that was nearing the close of its active phase among ground squirrels (*Citellus beecheyi*) in part of Kern County, California. Infection was demonstrated in fleas from the ground squirrels a fortnight after the last infected squirrel was taken. Just outside the plague area, *Echidnophaga gallinacea*, Westw., was found on ground squirrels and on one example of the burrowing owl (*Speotyto cunicularia*), which occurs in association with them [*cf. R.A.E.*, B **27** 205]. The owl yielded 70 specimens of the flea, which on mass-inoculation into a guineapig proved to be infected with plague. This is apparently the first record of a bird as a carrier of plague-infected parasites and the first demonstration of natural plague infection in *E. gallinacea*.

HEADLEE (T. J.). **Further Studies of the relative Effects on Insect Metabolism of Temperatures derived from Constant and Variable Sources.**—*J. econ. Ent.* **34** no. 2 pp. 171–174, 1 fig., 1 ref. Menasha, Wis., 1941.

The conclusion reached in the first paper of this series [*R.A.E.*, B **29** 45] that the effect of varying and constant temperatures on

insect metabolism appears to depend on where they lie in the temperature scale of the insect or stage concerned was confirmed in further work on *Aëdes aegypti*, L., in which tests were made in duplicate at three sets of varying and constant temperatures, 100 larvae being used in each series or 1,200 in all. The days elapsing between hatching and maximum emergence at constant and variable temperatures and (in brackets) the percentages of larvae reaching the adult stage were : 24·2 (86·5) and 17·7 (91·5) at 65 and 50–80°F. ; 15·7 (85·5) and 15·1 (88·0) at 75 and 60–90°F. ; and 13·5 (73·0) at 85°F. All larvae died at 70–100°F. In an attempt to explain the apparent dependency of the effect of constant and variable temperatures on their position in the scale, larvae and pupae of *A. aegypti* were subjected to nine constant temperatures between 46 and 102°F. At 46, 54 and 102°F., the larvae did not mature. The number of days elapsing between hatching and adult emergence at 61, 68, 74, 81, 88 and 94°F. were 29, 19, 15, 11, 10 and 12, respectively. Calculations of the accumulation of the thermal constant based on the second series (that ranging from 60 to 90°F., which was the only one that lent itself to calculation) and on the entire straight-line section of the sigmoid curve for *A. aegypti* (68–81°F. with a constant at 74·5°F.) were then made. The days elapsing between hatching and emergence and the percentage of larvae reaching the adult stage were 14·5 and 83 at 74·5°F., and 13 and 89 at 68–81°F. The calculations are briefly explained. The results, which are given in tables, indicated that the speed of accumulation of the thermal constant is the factor underlying the apparent differences of effect between variable and constant temperatures.

MacCreary (D.). **Comparative Density of Mosquitoes at Ground Level and at an Elevation of Approximately One Hundred Feet.**—*J. econ. Ent.* **34** no. 2 pp. 174–179, 1 fig., 3 refs. Menasha, Wis., 1941.

To obtain quantitative data on mosquito abundance within the so-called " terrestrial " zone of the atmosphere, which is considered to extend upwards 150–200 ft., New Jersey (vertical model) mosquito traps [*cf. R.A.E.*, B **23** 151] were operated in pairs at different heights on two lighthouse towers, one in northern and one in southern Delaware between 17th July and 15th September 1940. In the first area, where the mosquito fauna was composed largely of fresh-water forms, 2,546 females including 14 identified species were caught in the trap 4–5 ft. above ground level and 87 females including 10 identified species in one 103 ft. above the ground. The traps were operated for 54 nights and caught females on 42 and 26 nights, respectively. The catch of the upper trap included one female of *Anopheles barberi*, Coq. This is the first published record of this species in Delaware. An unusual feature of the collections at the upper trap was the large number of males of *Aëdes vexans*, Mg., taken, 92 per cent. of the total catch on the nights of 8th and 9th September being of that sex. On the same nights, the males collected in the lower trap were only 24 per cent. of the total. At the second locality, where the mosquitos were mostly of salt marsh origin, the lower trap took 14,325 females of 15 species, while the higher one, which was 80 ft. above ground level, took 1,324 females of 11 species. The traps were operated for 60 nights ; the lower one took females each night and the upper one on only 43 nights. There was a considerable difference in the relative abundance of the various species taken in the two traps. The records

of an enormous flight that occurred on the night of 10th September in southern Delaware are treated separately. The upper trap collected 13,555 females on this one night, and the lower one nearly 250,000. *Aëdes taeniorhynchus*, Wied., represented 70 and 85 per cent. of the females in the lower and upper traps, respectively. The numbers of *A. sollicitans*, Wlk., which was second in abundance, *A. vexans*, Mg., and *Culex salinarius*, Coq., would have been considered very large in an average collection, but formed only a small percentage of this one. The flight was confined to the southernmost portion of the State; the night was warm and humid and followed a warm and humid day. The proportion of *A. taeniorhynchus* and *C. salinarius* was greater in the total collections of the upper trap than in those of the lower, and that of *Anopheles crucians*, Wied., and *Aëdes sollicitans* was greater in the lower than in the higher, both in the collection of 10th September and in regular collections in the same locality.

MENTZER (R. L.), DAIGH (F. C.) & CONNELL (W. A.). **Agents for increasing the Toxicity of Pyrethrum to Mosquito Larvae and Pupae.** —*J. econ. Ent.* **34** no. 2 pp. 182–186, 1 fig., 5 refs. Menasha, Wis., 1941.

An account is given of experiments to determine whether the effectiveness against mosquito larvae and pupae of an emulsion of oil containing pyrethrum extract, prepared according to Ginsburg's formula [*R.A.E.*, B **23** 205] with a light fuel oil substituted for kerosene, is increased by the addition of pine oil [*cf.* **24** 304], ethylene glycol ether of pinene (D.H.S. Activator) [*cf.* **28** 180, 181] or a terpene cyanoacyl compound, fenchyl thiocyanoacetate (Thanite). For preliminary tests, a long series of combinations was prepared by adding these activators in varying quantities to three oil emulsions, the first of which was the standard larvicide, while the others were similar except that one contained only half as much pyrethrum extract and the other none. Five combinations were finally selected for comparison with the standard. The oil in two contained the same amount of pyrethrum extract as the standard and either 5 per cent. D.H.S. Activator or 10 per cent. pine oil, while that in the other three contained only half as much pyrethrum extract and either 5 per cent. D.H.S. Activator, 15 per cent. pine oil or 2·5 per cent. Thanite. Laboratory tests, usually fourfold, with untreated controls, were made with larvae and pupae of *Culex pipiens*, L., *Aëdes vexans*, Mg., and *A. sollicitans*, Wlk. The technique is described. Counts were made 1, 4 and 24 hours after treatment. Field tests were also carried out with *A. sollicitans* in a salt marsh in Delaware, and counts made 24 hours after treatment. The percentage mortalities of each species effected after the various intervals had elapsed by each of the six larvicides diluted at 1 : 10 and 1 : 20 and applied at 50 U.S. gals. per acre are given in a table. In the laboratory tests, all larvicides diluted at 1 : 10 were more toxic than those diluted at 1 : 20, and *A. vexans* was more resistant than the other species. There was some indication that pupae were more susceptible than larvae to materials at 1 : 10, since higher mortalities after 1 and 4 hours were often recorded. The difference in toxicity between the larvicides appeared more pronounced in the case of the 1 : 20 than the 1 : 10 dilutions, especially after 4 and 24 hours. All experimental combinations were more toxic than the standard after 1, 4 and 24 hours when diluted at 1 : 10, and after 24 hours when diluted at 1 : 20.

Both with regard to toxicity and cost, an emulsion in which the oil contains half as much pyrethrum extract as the standard and 5 per cent. D.H.S. Activator, used at the recommended dilution of 1 : 10, was the most satisfactory. In the field tests, each experimental combination at 1 : 10 killed a higher percentage of larvae than that (95) killed by the standard. The toxicity at 1 : 20 was usually equally satisfactory. No harmful effect on fish (*Fundulus* spp.) or salt marsh vegetation (*Spartina*) was noticed.

CONNELL (W. A.). **Hatching Response of *Aëdes sollicitans* Eggs under selected and controlled environmental Conditions.**—*J. econ. Ent.* **34** no. 2 pp. 187–192, 2 figs., 4 refs. Menasha, Wis., 1941.

The following is based on the author's summary. Eggs deposited on moist paper by females of *Aëdes sollicitans*, Wlk., collected in the field were placed on dampened cones of absorbent paper within 24 hours. To control the moisture content of the paper, the cones were kept in containers in which the humidity was regulated. Different groups of eggs were immersed in plant infusions [*cf. R.A.E.*, B **27** 231], distilled water, creek water or sodium-chloride solutions for periods of 1 hour or 6 hours every 1, 2 or 5 days until all had been flooded ten times. The infusions were made by steeping 1·5 gm. of plant material in 150 cc. of distilled water for 2 hours at 80°F. The effect of continuous submergence was also studied. Several of the plant infusions stimulated the hatching of a high percentage of the eggs, but only when flooding was interrupted. When the eggs were flooded for 1 hour every day in infusions of *Spartina alterniflora*, *S. patens* and *Distichlis spicata*, plants characteristic of highly saline marshes, the percentages that hatched were 82, 76 and 48, respectively ; in infusions of *Scirpus olneyi*, *Panicum virgatum* and *Spartina cynosuroides*, plants from marshes of lower salinity, they were 73, 63 and 25, in infusions of *Zizania palustris* from fresh-water tidal marshes and *Cyperus ferox*, which grows in wet meadows in the interior, they were 64 and 35, and in infusions of *Juncus effusus* from wet meadows and *Typha angustifolia* from marshes of low salinity they were 12 and 7. These results indicate that plants capable of influencing the hatching of the eggs are more widely distributed than the known breeding places of the mosquito in Delaware. The hatching stimulant appeared to be present in varying quantities in water taken from a salt marsh creek (0·7 per cent. chlorine) in which 4–50 per cent. of the eggs hatched in different groups. In most instances, not more than 10 per cent. hatched in sodium chloride solutions ranging from 0·5 to 2·0 per cent. chlorine. The results suggest that this salt, although not the hatching stimulant, may be an accessory that aids hatching or increases the rate of production of the stimulation in the infusions. Less than 5 per cent. of the eggs hatched in distilled water. It apparently made little difference whether the eggs were submerged for 1 hour or 6 hours if they were kept on a wet surface when exposed to the air. Those that were kept continuously submerged, however, failed to hatch during the observations, which lasted three months. When the eggs were exposed to air on saturated paper between immersions, a few hatched at the second flooding if they were then 3 days old and an equally small proportion of 5-day-old eggs hatched at the first flooding. None hatched after the ninth flooding, and most that hatched had done so by the end of the fourth submergence at intervals of 2 or

5 days. Some eggs did not survive for 30 days when kept on a moist surface at temperatures between 75 and 85°F., and only a few hatched after 11 months of similar storage. The temperature and moisture conditions under which these tests were carried out were within the range for the summer months of 1939 on a Delaware marsh. This suggests that degeneration may occur at a similar rate in the field.

FELLTON (H. L.). **The Use of Chlorinated Benzenes for the Control of Aquatic Midges.**—*J. econ. Ent.* **34** no. 2 pp. 192–194, 1 fig., 1 ref. Menasha, Wis., 1941.

The problem of the control of Chironomids breeding in two lakes at the site of the New York World's Fair, the species involved and the methods used for control in 1939 were reported in a previous paper [*R.A.E.*, B **29** 42]. The present one deals with laboratory and field investigations and field operations using orthodichlorobenze [*cf.* **29** 44] and trichlorobenzene. In laboratory work during the winter of 1939–40, the toxicity of both compounds to larvae of *Procladius* and *Chironomus* appeared variable, but 80 per cent. mortality was obtained in most cases, and often 100 per cent. when applications were made at the rate of 15–30 U.S. gals. per acre. The addition of an emulsifying agent such as sulphonated castor oil decreased toxicity. Trichlorobenzene was somewhat the more potent. In the spring, when the water temperature was 50°F., orthodichlorobenzene was applied at the rate of 22 U.S. gals. per acre to about two acres of one lake. There were few *Chironomus* larvae in the area before treatment and no live ones were found after it. Approximately equal numbers of *Procladius* larvae were taken in samples before and after treatment, the percentages dead being 9·1 and 85·3, respectively.

On the basis of these tests, it was decided to treat the entire breeding area with orthodichlorobenzene when the water temperature was likely to be close to the freezing point of trichlorobenzene (48·2°F.) and with the latter when the season was more advanced. As both the substances, though heavier than water, fail to break through the surface tension if sprayed in fine droplets over the surface, they were applied as a fine spray under it by means of specially constructed outfits, the construction of which is described, mounted in small motor boats.

Five treatments, at approximately monthly intervals, were made during the breeding season in 1940, the first three with orthodichlorobenzene at 25, 22 and 21 U.S. gals. per acre, respectively, and the last two with trichlorobenzene at 16 U.S. gals. per acre. *Procladius* adults were rarely seen during the season. Control of *Chironomus* was more difficult, as populations built up rapidly in the lake bottoms between treatments, but very few adults emerged. The larvae tended to migrate from areas that had just been sprayed, particularly towards the shoreline, which therefore required careful treatment after the body of the lake had been sprayed. This was particularly so when orthodichlorobenzene was used, trichlorobenzene appearing to be much more rapid in its toxic effect.

PIERPONT (R. L.). **Effect of a Terpene Ether on certain Fly Sprays.**—*J. econ. Ent.* **34** no. 2 pp. 195–197, 1 fig., 3 refs. Menasha, Wis., 1941.

It has been shown that ethylene glycol ether of pinene (D.H.S. Activator) increases the toxicity of fly-sprays containing pyrethrum

extract or rotenone [*R.A.E.*, B **28** 181]. In the experiments described in this paper, it also increased the toxicity to *Musca domestica*, L., of oil containing pyrethrum extract and an aliphatic thiocyanate, but not that of sprays containing the thiocyanate without the pyrethrum extract. It was thus clear that the increased toxicity was due to the activation of the pyrethrum only. The degree of efficiency of the combined sprays depended on the amounts of the several materials contained in them. In every case, the increases obtained by the addition of 5 per cent. of D.H.S. Activator were greater than those obtained by the addition of 3 per cent. The materials were shown to be compatible by an experiment in which the mixture was allowed to stand for 24 hours.

Knowlton (G. F.) & Hall (D. G.). **Flesh Fly kills Kit Mink.**—*J. econ. Ent.* **34** no. 2 p. 216. Menasha, Wis., 1941.

Considerable annual losses have been caused to fur farmers in Utah and Idaho by infestation of young mink by larvae of *Wohlfahrtia opaca*, Coq., one farmer having lost 450 animals in 15 days during the spring of 1939; silver-fox cubs on this and other farms have also been infested and killed during spring. Though very young animals are usually affected, larvae may be found in mature ones. A full-fed larva was recovered from an adult guineapig during the summer of 1935.

First-instar larvae are deposited on the hair and penetrate the skin almost immediately. Each boil-like wound usually contains one larva, but sometimes includes two or three, and as many as 30–40 may attack a single animal. Infestation is usually fatal. The enclosure of all brood mink cages in one fly-proof structure practically eliminated infestation on at least two farms during 1940.

Buddington (A. R.). **The Nutrition of Mosquito Larvae.**—*J. econ. Ent.* **34** no. 2 pp. 275–281, 18 refs. Menasha, Wis., 1941.

Experiments on the factors involved in the nutrition of mosquito larvae were begun in Maryland in 1936 using *Aëdes aegypti*, L., and *Culex pipiens*, L., reared in the laboratory. Some of the relevant literature is reviewed. The numbers of sterile eggs or day-old larvae of each species used in tests of various media and the numbers that reached the fourth instar and pupal and adult stages are shown in tables. Autoclaved pond water and pond water passed through a Berkefelt W filter supported the growth of the larvae only as far as the fourth instar. In an autoclaved medium containing oyster meal, dried yeast, glucose, and Osborne-Mendel salt mixture, inoculated with *Bacillus subtilis*, 64 per cent. of *A. aegypti* and 32 per cent. of *C. pipiens* pupated, and 61·5 and 29 per cent. emerged as adults. The corresponding figures when the medium was inoculated with *Saccharomycetes cervisae* were 75, 74, 72 and 72, but *B.* (*Escherichia*) *coli* did not support growth to the adult state. Larvae could not develop beyond the fourth instar in a similar autoclaved medium alone, but when a heavy suspension of alcohol-filtered yeast was used with the autoclaved glucose and salt, 69·5 per cent. of *A. aegypti* and 65 per cent. of *C. pipiens* reached the adult stage. To test the growth of larvae on sterile media

plus vitamins, a basal autoclaved medium of autoclaved oyster meal, glucose and Osborne-Mendel salt solution was used, since heating destroyed the growth-promoting qualities of yeast, and crystalline vitamins were added at 1 mg. per 500 cc. In some instances, yeast (0·1 per cent.) was added to the basal medium before autoclaving. Under these conditions, thiamin hydrochloride (B_1), riboflavin (B_2), each in the presence of yeast, and the two together without yeast failed to support growth beyond the fourth instar, but with either autoclaved yeast or autoclaved liver extract and the two vitamins together, about 80 per cent. of each species reached the adult stage. It is thus shown that vitamins B_1 and B_2 and, in addition, at least one heat-stable substance in autoclaved yeast or liver extract are required. When tested together as a substitute for the latter, thiamin hydrochloride, riboflavin, ascorbic acid (Vitamin C) and nicotinic acid failed to support growth beyond the fourth instar. Non-sterile larvae failed to develop beyond the fourth instar in a filtered solution containing seven amino acids, thiamin hydrochloride, riboflavin, adermin, liver concentrate, glucose and Osborne-Mendel salt mixture. The ways in which autoclaving and filtration affect the properties of pond water as a rearing medium are discussed.

Shannon (R. C.) & Hadjinicalao (J.). **Egg Production of Greek Anophelines in Nature.**—*J. econ. Ent.* **34** no. 2 pp. 300–305, 8 refs. Menasha, Wis., 1941.

A study here reported of the egg capacity and egg size of three forms of *Anopheles maculipennis*, Mg., occurring in Greece (*subalpinus*, Hackett & Lewis, *typicus*, and *sacharovi*, Favr) has added to the evidence that this species consists of distinct biological varieties. Data on *A. superpictus*, Grassi, are included for comparison. Practically all the material was collected in Macedonia in 1934 and 1935. There were consistent differences between the forms on the bases of wing length, egg length and numbers of eggs per batch. The forms that were not well separated on one basis were so on another. The number of eggs in batches laid by individuals of the same variety differed greatly ; it was correlated with the size of the female, as estimated by wing length, which varied with season and type of breeding place. Adults of early spring and late summer generations were noticeably larger than midsummer ones. The difference in egg length between the different forms was small but consistent, and could well account for differences in their egg capacity. Less than half the egg batches of *superpictus*, *sacharovi* and *typicus* but over three-quarters of those of *subalpinus* comprised more than 250 eggs. Records of winter and spring egg development showed that eggs of *subalpinus* and *typicus* develop somewhat earlier than those of *sacharovi*, while those of *superpictus* develop a month later. The data on wing length and number and size of eggs are analysed statistically. The analysis indicates that the number of eggs is by far the most variable of the measurements considered, probably because it reflects the influence of various outside factors. It is believed that the average number of eggs laid by females of any member of the group is determined almost entirely by the average size of its females during the season in question and the average length of the eggs. A formula is given for calculating the number of eggs likely to be produced by a female in one batch.

KNIPLING (E. F.). **Toxicity of certain Chemicals to the Fleece Worms** *Phormia regina* **(Meig.),** *Cochliomyia macellaria* **(F.) and** *Lucilia sericata* **(Meig.).**—*J. econ. Ent.* **34** no. 2 pp. 314–317, 2 refs. Menasha, Wis., 1941.

The relative toxicity of 30 organic and 7 inorganic compounds to larvae of *Phormia regina*, Mg., *Cochliomyia macellaria*, F., and *Lucilia sericata*, Mg., the species of most importance in causing fleece-worm infestation or cutaneous myiasis in sheep in the United States, was determined, using a technique based on that of Bushland [*R.A.E.*, B **29** 83] but with ground beef substituted for the more complex medium. The organic compounds tested were among those previously found to be toxic to *C. hominivorax*, Coq. (*americana*, Cush. & Patt.) [*loc. cit.*]. The inorganic ones, boric acid and arsenical compounds, are already in use against cutaneous myiasis of sheep and were included primarily as a standard of comparison. Concentrations of 0·1 and 0·25 per cent. were usually tested first, and if the minimum lethal concentrations did not fall in this range, higher and lower concentrations were tried. Materials that did not produce complete mortality at concentrations of 0·5 per cent. were discarded. The results are shown in detail in a table and discussed. Diphenyl sulphoxide, *p*-nitroanisole, azobenzene, diazoaminobenzene, *p*-nitrophenetole, phenothioxin, *m*-dinitrobenzene, *p*-chlorodiphenyl, hydrazobenzene, *p*-nitrotoluene and benzeneazodiphenylamine were the most toxic of the organic compounds to all the species. The toxicity of some of them approached that of sodium arsenite, the most toxic arsenical compound tested. Boric acid showed considerable toxicity to all three species. *L. sericata* was the most resistant species to arsenical compounds and in general to the organic compounds. *P. regina* exhibited slightly greater tolerance than *C. macellaria* to both the organic and inorganic compounds.

FRINGS (H.). **Rearing Blowflies in the Laboratory.**—*J. econ. Ent.* **34** no. 2 p. 317. Menasha, Wis., 1941.

Details are given of cages used for adults of *Cynomyia cadaverina*, R.-D., with devices by means of which water, food and meat for oviposition were provided, the way in which larvae and pupae were kept in glass aquaria, and the trap cage in which the flies were collected on emergence. The equipment and technique is simple and facilitates the rearing of great numbers of flies with a high degree of cleanliness and small expenditure of time. It should be suitable for other blowflies.

JONES (G. D.). **Screwworms in Man in Missouri.**—*J. econ. Ent.* **34** no. 2 p. 320. Menasha, Wis., 1941.

Descriptions are given of three cases of infestation of man by *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) in south central Missouri in 1939 at the height of an outbreak on domestic animals. Two of the infestations were in the nasal passages and one on the breast. Each consisted of some 25–30 larvae. All cases were successfully treated by using chloroform to kill the larvae and removing them.

Bonnell (D. E.) & Mote (D. C.). **The Klamath Midge.**—*J. econ. Ent.* **34** no. 2 p. 325, 6 refs. Menasha, Wis., 1941.

Midges, principally *Chironomus utahensis*, Mall., have occurred in enormous numbers in the area of the Upper Klamath Lake in south central Oregon for the past ten years, and have occasioned considerable annoyance and loss to residents. At the same time, there have been vast masses of algae on the lake. The adults are common from June till October. The eggs are attached to floating matter in masses of 1,000–2,000. The larvae make tubes of silk and débris as soon as they hatch, and feed on small algal filaments, diatoms, desmids, fragments of minute Crustacea and possibly bacteria. The winter is passed in the larval stage, which in summer lasts about 20 days. The larvae pupate in their tube, and the pupal stage lasts about 4 days. At the end of this time, the pupae leave the tubes and move about in the water, finally rising to the surface. There are numerous parasites and predators of both adults and larvae, including two species of fish. Control by means of both light-traps and chemicals was attempted. Light-traps caught very large numbers in 1939, but it is doubtful whether they would constitute a control measure. Some chemicals were applied to the surface of the water against ascending pupae and others to the bottom against the larvae, and some, particularly thiodiphenylamine (phenothiazine) and crushed salt, approached laboratory expectations.

McCormick (E. M.). **The Relation between the Amount of Arsenic a Fish gets from Mosquito-control Dusting and the Lethal Dose.**—*J. Tenn. Acad. Sci.* **15** no. 3 pp. 342–351, 5 refs. Nashville, Tenn., 1940. [Recd. 1942.]

Details are given of experiments on the effect on fish, particularly *Gambusia* and a catfish, of dusting with Paris green against Anopheline larvae in the neighbourhood of the Reelfoot Lake, Tennessee. There was no evidence that fish were killed. Those caught in nature showed the presence of arsenic on the body but not in the alimentary tract. Some of those exposed to Paris green in the laboratory died, but probably not from arsenical poisoning. Although a very small amount of arsenic was found in one batch of two alimentary tracts, and death in this case might possibly have been due to poisoning, no arsenic was found in the other fish that died, and the positive result may have been caused by the accidental inclusion of a part of the body in the test material. Moreover, other fish survived in water treated with much larger quantities of Paris green.

Barnickol (P. G.). **Food Habits of *Gambusia affinis* from Reelfoot Lake, Tennessee, with special Reference to Malaria Control.**—*J. Tenn. Acad. Sci.* **16** no. 1 pp. 5–13, 9 refs. Nashville, Tenn., 1941.

Rice (L. A.). ***Gambusia affinis* in Relation to Food Habits from Reelfoot Lake, 1940, with special Emphasis on Malaria Control.**—*T. c.* pp. 77–87, 10 refs.

In the first paper, an account is given of the results of an examination of the stomach contents of 316 individuals of *Gambusia affinis* collected from ten stations in the littoral zone of Reelfoot Lake, Tennessee,

in 1939, in which plant material, mostly *Wolffia*, was found to compose 24·7 per cent. by volume of the food and animal material 35·6 per cent., the remainder being digested matter or other débris. Insects formed 22·4 per cent. of the whole, but larvae of *Anopheles* and *Culex* comprised only 0·4 and 0·5 per cent. and were found in only two and eight stomachs, respectively. The food of the young fish was practically confined to plankton. Experiments showed that Anopheline larvae can usually be identified as such and sometimes specifically identified during their passage through the stomach and intestine, and that the fish devour the larvae readily, but only when the latter are in motion. It is concluded that the dense aquatic vegetation of Reelfoot Lake and small pieces of débris afford so much protection that the fish are of practically no larvicidal value there.

The second paper deals with work in 1940. No mosquito larvae were found in the stomachs of *Gambusia* collected between 9th and 16th July, although dips from the zone with heavy vegetation showed an abundance of larvae of *Anopheles*, *Culex* and *Uranotaenia*. However, large fish only had been examined, and it was found that these were not plentiful in this zone but congregated in the shallow water under willows, whereas the smaller fish went among the vegetation and were seen to search for *Anopheles* larvae among *Ceratophyllum* and to take them if they moved. In an examination of the stomach contents of a total of 465 *Gambusia* taken between 9th July and 14th August from the same stations as those examined in 1939, 20 per cent. of the food was vegetable and 80 per cent. animal, the latter including 23·5 per cent. insects, 13 per cent. mosquito larvae, and 5 per cent. larvae of *Anopheles*. Mosquito and Anopheline larvae represented 25 and 10 per cent. of the food of 154 *Gambusia* from an area of heavy vegetation, but were not found in 125 from open water and areas almost free of vegetation. The percentages of stomachs found to contain various forms of food by Barnickol in 1939 and the author in 1940 are compared in a table, the figures for Anophelines being 0·6 and 13·1. The reason for this difference is not known, but various explanations are suggested. The stomach contents of 46 individuals of *Fundulus dispar*, which is present in Reelfoot Lake at the ratio of 1 *Fundulus* to 40 *Gambusia* where vegetation is heavy and 1 : 100 where it is light, bore considerable resemblance to those of *Gambusia*, but 31·11 per cent. of the stomachs contained *Anopheles* larvae, which formed 10 per cent. by volume of the total food. From these data, it appears that both fish are of value in the control of mosquitos when they can reach them.

Wood (S. F.). **Notes on the Distribution and Habits of Reduviid Vectors of Chagas' Disease in the southwestern United States (Hemiptera, Reduviidae).**—*Pan-Pacif. Ent.* **17** nos. 2–3 pp. 85–94, 115–118, 8 refs. San Francisco, Calif., 1941.

A list is given of the Triatomids collected during field work on the distribution of the vectors of *Trypanosoma cruzi* in the south-western United States. They comprise eight species taken from the nests of wood-rats (*Neotoma* spp.) [*R.A.E.*, B **29** 191] and also *Triatoma longipes*, Barber [**29** 192]. The principal food used for the bugs in the laboratory was the blood of white rats. The method of exposing the rats to the bugs and of storing the bugs between feeds is described. Each of the nine species is then considered in detail. Lists are given of the localities in which uninfected individuals and infected ones, if any, were found.

The species found naturally infected with *Trypanosoma cruzi* were *Triatoma protracta*, Uhl., *T. protracta woodi*, Usinger, *T. rubida*, Uhl., *T. longipes*, and *T. gerstaeckeri*, Stål. The numbers of these species taken were 1,211, 489, 771, 152 and 55, respectively, the numbers examined were 957, 415, 230, 62 and 54 and the numbers infected 196, 20, 3, 10 and 3. *T. rubida* was referred to in a previous paper [**26** 144] as *Eutriatoma uhleri*, Neiva [which Usinger considers a subspecies of it (**28** 99)]. The numbers of the other four species found and usually the number examined are given, and also the numbers of each species found in wood-rat nests, houses, tents, etc., and the numbers of adults and small, medium-sized and large nymphs. Notes are included on the bionomics of the bugs. Three females of *Paratriatoma hirsuta*, Barber, were found infected 10 days after feeding on a *Peromyscus* that had been infected by inoculation. There were numerous crithidia in their faecal deposits, and 21 days after feeding, numerous trypanoform and crithidial stages were demonstrable. A white mouse inoculated with their faeces showed typical *Trypanosoma cruzi* in its blood 14 days later.

HOFFMANN (C. C.). **Nota acerca de la alimentación de las larvas pequeñas de** *Triatoma* **(Hemiptera, Triatomidae).** [A Note on the Nutrition of small Nymphs of *Triatoma*.]—*An. Inst. Biol. Mex.* **10** no. 3–4 pp. 343–346. Mexico, D.F., 1939. (With a Summary in German.) [Recd. 1942.]

In experiments with *Triatoma dimidiata*, Latr., *T. maculipennis*, Stål, *T. pallidipennis*, Stål, *T. phyllosoma*, Burm., and *T. sonoriana*, Del Ponte, which are the principal Triatomids that occur in dwellings in Mexico, it was observed that both nymphs and adults fed with equal readiness on man and small rodents, and the apparent preference shown in nature for the latter is considered to be due to their greater frequency and the greater likelihood of contact with them. Like the other stages, the first-instar nymphs can resist starvation for long periods provided that they are given a certain degree of humidity and access to water or other liquids. Coprophagy is connected with this need. Triatomids feed readily on insects, including members of their own species, and in many parts of Mexico their presence in houses coincides with heavy infestations by scorpions of the genus *Centruroides*. In experiments, young nymphs of *T. phyllosoma* readily attacked mated females of *C. limpidus*, Karsch.

HOFFMANN (C. C.). **La formación de razas de** *Anopheles* **mexicanos. III.** *Anopheles chiriquiensis* **Komp en el interior del Estado de Chiapas.** [The Formation of Races in Mexican *Anopheles*. III. *A. chiriquiensis* in the Interior of the State of Chiapas.]—*An. Inst. Biol. Mex.* **10** no. 3–4 pp. 347–352, 6 figs., 2 refs. Mexico, D.F., 1939. (With a Summary in German.) [Recd. 1942.]

In this third paper of a series [*cf. R.A.E.*, B **27** 122], the author states that adults of an Anopheline taken by him in June 1938 in a locality at an altitude of over 6,500 ft. in the State of Chiapas, southern Mexico, belong to race *guatemalensis*, De León, of *Anopheles chiriquiensis*, Komp [which latter has since been found to be identical with *A. parapunctipennis*, Martini (*cf.* **30** 12)]. Characters, chiefly of the wings, are given distinguishing this northern race from the form described by Komp from Panama [*cf.* **25** 73].

[Hoffmann (C. C.).] **Nota acerca de los mosquitos del Lago de Patzcuaro.** [A Note on the Mosquitos of Lake Patzcuaro.]—*An. Inst. Biol. Mex.* **11** no. 2 pp. 465–467, 1 fig. Mexico, D.F., 1940. [Recd. 1942.]

Malaria is endemic in the region round Lake Patzcuaro, in the State of Michoacan, Mexico, at an altitude of about 6,500 ft. The mosquitos observed there, a list of which is given, include two Anophelines, *Anopheles maculipennis* var. *aztecus*, Hoffmann, and *A. pseudopunctipennis*, Theo. The former is the more numerous and presumably the more important vector; it breeds freely in the stretches of aquatic plants and marshland along the banks of the lake in water with a pH of 7·5–8. The larvae are highly resistant to cold and occur throughout the year, and adults are found in houses even in winter. *A. pseudopunctipennis* bred in rain-water pools containing green algae. The adults were seen indoors in summer, but not in winter.

Pang (K. H.). **Isolation of Typhus Rickettsia from Rat Mites during Epidemic in an Orphanage.**—*Proc. Soc. exp. Biol. Med.* **48** no. 1 pp. 266–267, 8 refs. New York, N.Y., 1941.

A strain of typhus *Rickettsia* was established in guineapigs and white rats from 3 examples of *Liponyssus bacoti*, Hirst, taken from a rat trapped in 1940 at the end of a typhus epidemic in a Chinese orphanage. The mite infestation was low, only 4 of 24 rats caught harbouring a few individuals each. No mites were seen in the living quarters. There were, however, many infected fleas on the rats, so that the importance of the mites as vectors [*cf. R.A.E.*, B **20** 49] is doubtful.

Papers noticed by Title only.

Buxton (P. A.). **A Key to the adult *Anopheles* Mosquitos of the Mediterranean Region and the Lands adjoining the Red Sea and Persian Gulf.**—6 pp. multigraph. London Sch. Hyg. trop. Med. [1942.]

Quinby (G. E.). **Additions to the Mosquitoes (Culicidae) of the Reelfoot Lake Region.** [Complete list including eight additional species.]—*J. Tenn. Acad. Sci.* **16** no. 1 pp. 17–21, 11 refs. Nashville, Tenn., 1941. [*Cf. R.A.E.*, B **27** 128.]

Reichenow (E.). **Der Entwicklungsgang des Küstenfiebererregers im Rinde und in der übertragenden Zecke.** [The Course of Development of the Causal Agent (*Theileria parva*) of African Coast Fever in Cattle and in the Tick (*Rhipicephalus appendiculatus*, Neum.) that transmits it.]—*Arch. Protistenk.* **94** pt. 1 pp. 1–56, 3 pls., 30 refs. Jena, 1940. [Recd. 1942.] [For briefer account see *R.A.E.*, B **28** 76.]

Hoffmann (C. C.) & Nieto Roaro (D.). **Segunda contribución al conocimiento de los venenos de los alacranes mexicanos.** [Second Contribution to the Knowledge of the Poisons of Mexican Scorpions.]—*An. Inst. Biol. Mex.* **10** no. 1–2 pp. 83–92, 4 refs. Mexico, D.F., 1939. [Recd. 1942.] [*Cf. R.A.E.*, B **25** 48.]

Islas S. (F.). **Observaciones acerca del desarrollo y caracteres morfologicos de** *Triatoma picturata* **Usinger.** [Observations on the Development and morphological Characters of *T. picturata*.] —*An. Inst. Biol. Mex.* **12** no. 1 pp. 311–326, 4 pls. Mexico, D.F., 1941.

A detailed account is given of feeding experiments with nymphs of *Triatoma picturata*, Usinger, derived from females taken in the State of Nayarit, Mexico. Nymphs in the second or subsequent instars would not feed on scorpions and were sometimes destroyed by them. Feeding was continued on guineapigs. The developmental cycle lasted 424–675 days. All stages are described. Many of the adults, chiefly males, were indistinguishable from *T. longipennis*, Usinger.

Weinman (D.). **Bartonellosis: a Public Health Problem in South America.**—*Rev. Med. trop. Parasit.* **6** no. 5–6 pp. 277–281, 15 refs. Havana, 1940. (Repr. in *J. trop. Med. Hyg.* **44** no. 10 pp. 62–64, 15 refs. London, 1941.)

In view of the recent, and apparently progressing, spread of human bartonellosis in South America and the seriousness of an outbreak that has occurred in Colombia, data on the subject and on the causal organism, *Bartonella bacilliformis*, are reviewed. Infection of man may be asymptomatic, a matter of considerable epidemiological importance, or produce a disease that usually develops into one of two clinical types. In the haematic form (Oroya fever), the organisms are found in blood films, as well as in the vascular endothelial cells of the viscera; in the less serious cutaneous form (verruga peruana), they are not seen in blood films, but are found in impression films or sections of the eruptive elements. Blood cultures are positive in both forms of the disease, and are the only means of detecting the asymptomatic infection. *B. bacilliformis* is also pathogenic to certain monkeys, notably *Macacus rhesus*.

Prior to the Colombian outbreak, the disease was thought to be limited to a rather restricted area in Peru, but an endemic focus was found in the south-western part of Colombia in 1939, and another was reported in Ecuador, near the Peruvian border, in 1940. The outbreak in Colombia involved considerable areas, and the death rate was high. The infected zone was estimated to comprise nearly 400 square miles in the spring of 1938, and 4,000 deaths in that year were attributed to bartonellosis in a department (Nariño) with a population of 100,000.

If confirmed, certain new features reported in the Colombian outbreak will change the present concept of the epidemiology of the disease. Its limited distribution in Peru was attributed to that of the species of *Phlebotomus* considered to be the vectors [*cf. R.A.E.*, B **27** 25, etc.]. In Colombia, however, the louse [*Pediculus humanus*, L.] is suspected of being an important vector, and it is suggested that ticks of the genus *Ornithodoros* may transmit the disease. It is also claimed that Colombian strains of *Bartonella* are highly pathogenic to guineapigs, though Peruvian strains produce no disease or evidence of infection in these animals, even when they are splenectomised.

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VANDERPLANK (F. L.). **Activity of *Glossina pallidipes* and the Lunar Cycle (Diptera).**—*Proc. R. ent. Soc. Lond.* (A) **16** pt. 4–6 pp. 61–64, 1 graph. London, 1941.

The following is substantially the author's summary of this account of observations the locality and conditions of which will be described in a future paper. The numbers of *Glossina pallidipes*, Aust., caught on days following moonlight nights were significantly smaller than the numbers caught on days following moonless nights. Two methods of catching the flies, on moving and on tethered oxen, were used, and the data are treated separately. The results of correlating the catch with the amount of moonlight on the previous night are given for catches on both moving and stationary animals. The correlations were highly significant. A table and graph showing the mean total catches and the corresponding phases of the moon for each method of catching are given. The graph shows an S shaped curve in both cases. It is inferred that *G. pallidipes* is more active on a moonlight night than a dark one and so less active during the following day, and a few observations on the taking of this species at night are mentioned.

ROUBAUD (E.). **Phénomènes d'amixie dans les intercroisements de culicides du groupe *pipiens*.**—*C. R. Acad. Sci.* **212** no. 7 pp. 257–259, 2 refs. Paris, 1941.

Although it has been shown that fertile hybrids can be produced by crossing *Culex pipiens*, L., with *C. fatigans*, Wied. [*cf. R.A.E.*, B **24** 271], the author obtained adult offspring from crosses between these species only when the autogenous variety [*molestus*, Forsk.] of *C. pipiens* was used and the numbers produced were relatively small. He experienced similar difficulty in crosses between various races of *C. pipiens*. These data indicate the relative stability in nature of biological differences in races that are very similar in morphology, but the possibility of accidental crossing cannot be excluded.

COLAS-BELCOUR (J.). **Sur le cycle évolutif de deux ornithodores de grande taille, *Ornithodorus canestrinii* Birula 1895 et *O. delanoei* Roubaud et Colas-Belcour 1931.**—*C. R. Acad. Sci.* **212** no. 12 pp. 512–514, 14 refs. Paris, 1941.

The author gives details of the development of *Ornithodoros canestrinii*, Bir., and *O. delanoëi*, Roub. & Col.-Bel., at a constant temperature of 28°C. [82·4°F.] and a relative humidity of about 90 per cent., the host being guineapig or rabbit, and compares it with that of other ticks of the same genus. They resembled several species in having 4 nymphal stages in the males and 5 in the females, but the periods of larval feeding averaged 15 and 6 days, respectively. Such long periods are characteristic of various species of *Argas*, but, apart from these two large ticks, occur in the genus *Ornithodoros* only in species that do not feed in the first nymphal instar or in those that complete several successive instars on the same host.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Gîtes larvaires observés dans l'agglomération parisienne de deux moustiques arboricoles.**—*C. R. Acad. Sci.* **213** no. 3 pp. 102–104, 6 refs. Paris, 1941.

The adults of *Aëdes pulchritarsis*, Rond., and *A. geniculatus*, Ol., which breed in tree-holes, have been taken in Paris and other towns in

France. *A. geniculatus* has been shown to be a possible vector of yellow fever [*cf. R.A.E.*, B **25** 201]. Their breeding places are difficult to detect, but in 1940 the author found eggs of both species in a deep cavity in a tree in a garden near Paris. The deposit from the cavity was immersed in tap water several times during the winter and larvae of *A. pulchritarsis* hatched in December 1940, and those of *A. geniculatus* in January 1941.

BLANC (G.) & BALTAZARD (M.). **Transmission du bacille de Whitmore par la puce du rat *Xenopsylla cheopis*.**—*C. R. Acad. Sci.* **213** no. 16 pp. 541–543. Paris, 1941.

The fact that infection with Whitmore's bacillus (melioidosis) occurs in rodents as well as man led the authors to investigate the possibility that it might be transmitted by *Xenopsylla cheopis*, Roths. Examples of this flea fed in batches on infected guineapigs, and then on healthy ones, transmitted the disease to the latter even when the possibility of infection of the animals by ingestion was excluded. One batch of 400 fleas, allowed to feed for 50 minutes at a time, successively infected 12 guineapigs after 1–9 meals, and 390 of them were still alive at the end of the test. The possibility of reinfection of the fleas was excluded by removing them on the appearance of the first symptoms, when blood cultures are still negative, and in one such test the fleas remained infective for 50 days. The infection persisted in the faeces of the fleas.

GUNTHER (C. E. M.). **A Survey of Endemic Typhus in New Guinea.**—*Med. J. Aust.* 1940 **2** no. 22 pp. 564–573, 58 refs. Sydney, 1940. [Recd. 1942.]

The disease dealt with in this paper, which has been reported from the Mandated Territory of New Guinea since 1930, clinically resembles tsutsugamushi disease, though it is in some respects more closely allied to Sumatran mite-fever [which is considered by some workers to be identical with tsutsugamushi disease (*cf. R.A.E.*, B **28** 190)]. The serum of patients agglutinates Proteus XK at moderately high titres, but not Proteus X19 or X2. In view of this and the fact that no patient ever gave a history of tick bite, the author concludes that the disease must be transmitted by mites, which attack man freely in the regions where it is endemic. A list is given of the Trombidiids of New Guinea with the hosts on which they have been found. On the assumption that the disease is likely to be transmitted by a mite that sometimes attacks man and constantly occurs on a rodent or similar animal that may be a reservoir, the only probable vector is *Trombicula minor*, Berl., 70 individuals of which were taken from 11 men, and the probable reservoir is the bandicoot, *Echymipera cockerelli*, which is one of its principal hosts.

HEASLIP (W. G.). **An Investigation of the Condition known as Coastal Fever in north Queensland: its Separation from Scrub-typhus.**—*Med. J. Aust.* 1940 **2** no. 22 pp. 555–564, 1 map, 3 graphs, 21 refs. Sydney, 1940. [Recd. 1942.]

The literature on the undiagnosed fevers that occur on the coastal strip of Queensland lying north of Townsville and of which the

best-known name is coastal fever is reviewed. Some workers reported that the serum of patients agglutinated Proteus XK, and that practically all the cases were " endemic typhus." In view, however, of the wide variation in clinical types, further investigations were begun in 1938, and an account of them is given in this paper, in which the term typhus is used to indicate the member of the group that gives rise to serum agglutinins of Proteus OXK only [and which the author subsequently calls tsutsugamushi disease (see next abstract)]. It was found that the great majority of patients were not infected with typhus but were suffering from a distinct disease that was a clinical entity and was always associated with the presence in the blood of a bacillus of the anthrax group [*Bacillus tropicus* (see next abstract)]. Furthermore, most of the minority who had typhus were also infected with this bacilllus. It was not present in patients suffering from other fevers, and it is therefore concluded that it is the cause of certain defined cases of pyrexia that have been called coastal fever and is not ordinarily a secondary invader, though it may occur as a double infection with typhus.

The bacillus was found in 5 out of 7 bandicoots (*Isoodon torosus*) examined and 46 out of 60 rats, which included four species of *Mus* (*Rattus*), *Melomys littoralis*, *Hydromys chrysogaster* and *Uromys caudimaculatus* ; and mice into which the contents of an engorged tick from a bandicoot were injected were affected in the same way as those into which clots were injected from the animals or from human patients. These results and the histories of the patients examined suggested that the infection is transmitted by a vector, and that one found in the bush (a mite or tick) or mosquitos must be suspected. Mosquitos are ubiquitous, but the known animal reservoirs could account for the restriction of infection to the bush and the vicinity of the West Cairns swamp. *Haemaphysalis humerosa*, Warb. & Nutt., bred from eggs from Cairns, transmitted the bacillus from infected to healthy mice by biting. In a series of cases of typhus from an area north of Cairns, in most of which a double infection was proved, there was a definite history of tick-attachment preceding the fever. However, a history of tick-attachment in coastal fever is so unusual that the tick could be only an occasional vector. There is no evidence that mites are not vectors. In the coastal area of north Queensland, rats are the usual reservoirs of both typhus and coastal fever, and it is probable that mites act as vectors for both infections at one time. A laboratory assistant in South Australia became infected with both (apparently through an abrasion on his finger) from mice infected after at least 30 serial passages with a strain of typhus brought from Cairns seven months before. Moreover, when larval ticks that had fed on mice infected with typhus subsequently transmitted the bacillus to healthy mice, the contaminated typhus strain had been passed in mice more than 20 times after leaving Cairns. It is probable that the bacillus can pass from the mite to the human host if the site of attachment is scratched and the mite crushed on it. Patients give no history of mite-infestation, but few people know what a larval mite is or recognise that it is responsible for the itchy papule that follows attachment. It thus appears that mites are the most likely vectors, but that infection may occasionally be transmitted by a tick. The disease occurs throughout the year, but the heaviest incidence follows the rainy season, when there is an increase in the number of mosquitos and larval mites and the rats are driven closer to dwellings by flooding of the swamps and cane-fields.

HEASLIP (W. G.). **Tsutsugamushi Fever in north Queensland, Australia.** —*Med. J. Aust.* 1941 **1** no. 13 pp. 380–392, 41 refs. Sydney, 1941.

The disease of the typhus group occurring in northern Queensland [see preceding abstract], which is here called tsutsugamushi disease on the assumption that tsutsugamushi disease, Malayan scrub typhus and Sumatran mite fever are identical [*cf. R.A.E.*, B **26** 20 ; **28** 190], was demonstrated in the bandicoot, *Isoodon torosus*, and rats, including *Melomys littoralis* and four species of *Mus* (*Rattus*). These animals were found to be attacked by at least 14 species of Trombidiids, including *Trombicula minor*, Berl. (*hirsti*, Sambon), which was not taken at low altitudes, and *T. deliensis*, Walch, which represented about 90 per cent. of all the mites. On only one occasion were larval mites found on man, and they were *T. hirsti*. In view, however, of the fact that tsutsugamushi disease is habitually associated with *T. akamushi*, Brumpt, or *T. deliensis*, the author considers that the latter is probably the vector in Queensland. He also considers that it is at most a variant of *T. akamushi* [*cf.* **20** 234].

It is stated that the bacillus associated with cases of this disease and another fever [see preceding abstract] has since been named *Bacillus tropicus*.

LENNOX (F. G.). **Some Experiences in the Preparation of Sheep Blowfly Dressings and a Description of a new Boric Acid Mixture.**—*J. Coun. sci. industr. Res. Aust.* **14** no. 2 pp. 77–87, 14 refs. Melbourne, 1941.

The properties of an ideal dressing for use on sheep attacked by blowfly larvae are given, and attempts in various parts of the world to produce satisfactory dressings containing no boric acid are reviewed, the methods used to this end at the laboratory of the Australian Council for Scientific and Industrial Research, the substances tried and their disadvantages being set out in some detail. Some previously recommended dressings containing boric acid [*R.A.E.*, B **23** 292 ; **28** 102, 103] require ingredients that are difficult to obtain or have unsatisfactory physical properties, and a new one containing boric acid, tar oil and bentonite, and referred to as B.T.B., is described. The specification, with the proportions in percentages by weight, is finely powdered boric acid (30), tar oil, straight fraction, with a boiling range of 170–210°C. (2), bentonite (Wyoming, U.S.A.) (2), wetting agent such as Agral 2 (0·5), water (65·5). If desired, the percentage of boric acid can be reduced to 15, but in this case, the bentonite content should be increased to 3 per cent., so that the water content is 79·5 per cent. The protective action of this cheaper dressing should be sufficient for most purposes. However, the experiments here recorded were made with the stronger one, which is referred to as B.T.B. 30. Each component and its function is described. It is best to mix the three solid ingredients together, add water gradually to form a thin suspension, and then the tar oil, with rapid shaking or stirring until it is uniformly distributed. The order in which the ingredients were mixed had a great effect on stability, which was also improved by using rain water. The stability, viscosity, fleece penetration and larvicidal effect of the dressing were all investigated before it was applied to blowfly strikes, and the findings are discussed. The physical properties were satisfactory, and the dressing

is not toxic to sheep. It was tested in Canberra on 22 artificial and 43 natural strikes. Under field conditions, many of the larvae left the wounds as soon as it was applied, and most of the remaining ones were killed within 10 minutes. A few survived for 24 hours, but they were always suffering from the effects of the poison by this time. Fresh pockets were never formed. The wounds healed well ; the scab was thin and flexible and usually separated from the wounds during the second week after dressing, and the wool began to grow immediately afterwards. The dressing was not irritant and gave protection against re-strike for some weeks. Eggs laid on dressed strikes failed to hatch, and larvae applied three weeks after dressing failed to establish re-strike. Only one natural re-strike occurred in the field, on the tail of a sheep that was scouring badly. The dressing adhered well except in heavy rain, but even then the strike healed satisfactorily. There was no evidence of any harmful effect on the fleece.

RICHES (J. H.). **The Relation of Tail Length to the Incidence of Blowfly Strike of the Breech of Merino Sheep.**—*J. Coun. sci. industr. Res. Aust.* **14** no. 2 pp. 88–93, 5 refs. Melbourne, 1941.

The following is substantially the author's summary. The results of two experiments carried out in Queensland, one begun in 1938 and one in 1939, to determine the effect of tail length on the incidence of breech strike and tail strike in sheep are reported. In the first, two groups of ewe lambs were docked to leave tail stumps about 4 and 2 ins. long, and a third was docked on a level with the buttocks. Individual strike records were kept, and during the first six months, when the majority of strikes occurred, the numbers per 100 sheep were 32·2 among those with long tails, 55·9 among those with medium tails, and 61·0 among those with short tails. In the second experiment, the procedure was similar, except that a group of undocked sheep was included. The preliminary results confirmed those obtained earlier, and were somewhat more strongly in favour of a tail not less than 4 ins. long. Strike in the sheep with undocked tails was slightly higher than in those with tails 4 ins. long. It is concluded that leaving the tail longer at docking than is at present customary is a valuable means of reducing the incidence of breech as well as of tail strike.

CHORLEY (J. K.). **Tsetse Fly Operations. Short Survey of the Operations by Districts.**—*Rhod. agric. J.* **38** no. 7 pp. 349–356. Salisbury, S. Rhod., 1941.

The areas completely cleared of *Glossina morsitans*, Westw., in the northern districts of Southern Rhodesia in 1940 remained approximately the same as in the previous year [*cf. R.A.E.*, B **30** 8]. It is too early to expect results from new areas included in the operations during the last two years. An appreciable improvement occurred in the older areas, where the density of fly has been reduced to vanishing point over fairly extensive tracts. Surveys are given of the operations against this tsetse in individual districts and those against *G. pallidipes*, Aust., and *G. brevipalpis*. Newst., in the Melsetter district, which they invade from Portuguese East Africa. The position in this district has greatly improved, only 132 cases of trypanosomiasis having occurred in cattle as compared with over 1,000 in the previous year. Extensive felling

operations were completed to widen part of the border clearing. Records are given of the number of flies of each species trapped in the clearing and on the Rhodesian side of it, where *G. pallidipes* was more widespread than *G. brevipalpis*. The continued advance of *G. morsitans* in the lower Sabi Valley in Portuguese East Africa towards the border at the southern end of this district necessitated the inception of controlled game elimination operations.

JACK (R. W.). **Report of the Division of Entomology** [Southern Rhodesia] **for the Year ending 31st December, 1940.**—15 pp. multigraph. [Salisbury, S. Rhod.] 1941.

The major part of the medical and veterinary section (pp. 5–11) of this report has been printed elsewhere [see preceding abstract]. *Chrysomyia bezziana*, Villen., continues to be of importance as a pest of cattle [*cf. R.A.E.*, B **30** 8], and larvae of this species were also recorded from the ear of a sheep and the skin at the base of the tusk of an elephant. Larvae of *Cobboldia* (*Platycobboldia*) *loxodontis*, Brauer, which was not previously known to occur in Southern Rhodesia, were removed from the stomach of an elephant. *Simulium rutherfoordi*, De Meill., and *S. simplex*, Gibbins, were found breeding in streams in November.

BUXTON (P. A.). **The recorded Distribution of certain Fleas.**—*Bull. ent. Res.* **32** pt. 2 pp. 119–122, 5 maps. London, 1941.

Maps are given showing the world distribution of *Xenopsylla cheopis*, Roths., *X. astia*, Roths., *X. brasiliensis*, Baker, and *Pulex irritans*, L., as determined from a study of the available literature published before the end of 1938 and the specimens in the Tring Collection, and of *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, based only on specimens in the Tring Collection. References in the literature to this species were ignored because many tropical records were considered unreliable, though this doubtless involved the rejection of many correct records.

MATHESON (C.). **The Distribution of** *Cimex lectularius* **in Towns in England and Wales.**—*Bull. ent. Res.* **32** pt. 2 pp. 165–171, 4 refs. London, 1941.

The following is substantially the author's summary. A brief historical account of the incidence of *Cimex lectularius*, L., in England is followed by an analysis of numerical data regarding infestation in 23 towns in England and Wales. The data indicate that in most cases the degree of infestation increases with the size of the town ; one or two exceptional cases are discussed. Comparison of the figures for inland towns and seaports suggests, though more data are desirable, that a low degree of infestation is common in the former, whereas the majority of the latter have a moderate or heavy infestation.

Insecticides against Bed-bugs in Shelters. Recommendations by a Committee of the M.R.C.—*Brit. med. J.* 1942 no. 4231 p. 195. London, 1942.

The following formulae against bed-bugs [*Cimex lectularius*, L.] in air-raid shelters are recommended by a committee of the Medical Research Council.

1. Pyrethrins in kerosene. The preparation to have a guaranteed content of 0·6–0·8 per cent. of the pyrethrins described as i and ii. Alternatively, a weaker pyrethrin solution made equally toxic for bugs by the use of an adjuvant harmless to man may be accepted.

2. Thiocyanates. (*a*) Lethane [butyl carbitol to thiocyanate] in kerosene. To have a guaranteed content of 6 per cent. " lethane 384" [*cf. R.A.E.*, B **28** 150]. (*b*) Lauryl [dodecyl] thiocyanate in kerosene. To have a guaranteed content of 3 per cent. lauryl thiocyanate.

3. Heavy coal-tar naphtha with cresylic acid. The cresylic acid (5 per cent.) to be dissolved in heavy coal-tar naphtha complying with the following specification. (*a*) Specific gravity at 60°F. : not less than 0·835 nor greater than 0·910. (*b*) Distillation range (S.T.P.T.C. apparatus) : not more than 10 per cent. shall distil at 160°C. and not less than 90 per cent. at 190°C. (*c*) Flash point (Abel) : not less than 100°F. (*d*) Tar bases : not to exceed 0·25 per cent.

These preparations should be used only when a shelter is empty and at least two hours before it is again occupied. The use of naked lights and smoking should be prohibited while handling and spraying these insecticides. Owing to the interaction of hypochlorites and pyrethrin, or even traces of cresylic acid, air disinfection of shelters cannot be carried out concurrently when either formula 1 or 3 is used. Several days should elapse between the two forms of treatment. Owing to the possible solvent action of heavy naphtha, care should be taken when using formula 3 to prevent its coming into direct contact with rubber. The committee emphasises that proper atomisation of the insecticide is essential when sprayed. Power sprayers in large shelters and hand sprayers of the " flit " types in smaller shelters are advocated. A brush might be used for cracks and other readily accessible places that might harbour the bugs. Much may be done to prevent infestations by the avoidance or obliteration of places likely to harbour the bugs, and cement-washing, distempering and painting may all be useful if supplies and labour are available.

Lewis (E. A.) & Fotheringham (W.). **The Transmission of *Theileria parva* by Ticks.**—*Parasitology* **33** no. 3 pp. 251–277, 19 graphs, 19 refs. London, 1941.

In a continuation of experiments in Kenya Colony on the transmission by ticks of *Theileria parva*, the causal organism of African coast fever of cattle [*R.A.E.*, B **26** 25 ; **27** 89], it was found that exposing engorged larvae of *Rhipicephalus appendiculatus*, Newm., to a temperature of 39·2–42·8°F. for three days beginning 0, 2, 4, 6, 8 and 9 days after repletion did not retard the development of *T. parva* in them. Such a low temperature rarely occurs for a continuous period of three days in the inhabited areas of Kenya. It was estimated that exposure to cold after 2–8 days in the incubator would show the effect of the low temperature on the earlier, more active and, presumably, more susceptible stages in the development of the parasite as described by Cowdry & Ham [*cf.* **20** 137 ; **28** 76]. It is concluded from the results of these and other experiments, including incomplete ones on the effect of high temperature and low humidity, that as long as the tick survives, climatic conditions do not kill or weaken the parasite [*cf.* **19** 58].

It was found that the disease was as virulent when transmitted by ticks fed in the tail brush of an infected animal as when transmitted by ticks fed on the ears. Reference is made to records of mild reactions

to African coast fever when the parasites were rare or absent, and instances are given of such reactions followed by recovery in experimental animals. A batch of ticks transmitted a fatal form of the disease from an animal showing a mild reaction. Although in some cases, the mild form accompanied infestation by only a few ticks, it was shown that a small number of ticks can transmit the fatal form. Data are given on two mild infections that would have been difficult to detect in the field but which conferred immunity from a virulent one. In two series of experiments, the disease was produced in a fatal form by ticks that had dropped from the infective animal on or after the sixth day of the reaction, but not by ticks that had dropped off earlier. Calculation in hours indicated that the ticks did not take up the infection until four days of reaction had elapsed. The period deemed necessary to cleanse an area badly infected with African coast fever, based on field experiments on the bionomics of *R. appendiculatus* the results of which were published by A. Theiler in 1904, is 15 months [*cf.* **18** 177–178]. It is known that adults can live 1,013 days, and nymphs 609 days, without a meal, under the sheltered condition of the laboratory, but it is doubted whether they could survive so long in nature. This longevity under controlled conditions facilitated investigations on the fate of *T. parva* in the tick. The findings suggested that the parasite disappears from infected hungry nymphs kept under laboratory conditions for a year or more. The tests with adults have not yet been carried out, but records indicate that those up to 280 days old transmit the disease, while those over 320 days old do not.

Several animals that had recovered from African coast fever some years previously were infested in the laboratory with large batches of *R. appendiculatus* in attempts to break down the immunity and produce turning-sickness [**24** 155], but no recovered beast became infected, and no case of turning-sickness was produced. Moreover, continued experiments on the transmission of African coast fever by ticks fed on animals suffering from turning-sickness did not confirm earlier positive results. These conflicting results may be explained on the basis of observations that turning-sickness, associated with the blocking of the small capillaries of the brain by lymphocytes containing schizonts indistinguishable from the Koch's bodies of *T. parva*, may be divided into three stages, namely, acute, subacute and chronic ; it is suggested that infection of ticks with *T. parva* from animals suffering from turning-sickness could normally be successful only if the animals were in the acute and early part of the subacute stage, since piroplasms afterwards disappear from the peripheral blood. The opinions of other workers on African coast fever are discussed in the light of the experiments and of field experience in Kenya, and the way in which the conclusions can be applied to the movement of cattle from endemic areas over country free from the fever is explained.

BINGHAM (M. L.). **A Note on the Bionomics of *Ixodes ricinus* L.**—*Parasitology* **33** no. 3 pp. 316–319, 5 refs. London, 1941.

Five batches of larvae of *Ixodes ricinus*, L., the progeny of five females of a stock being maintained in a laboratory in England, engorged on a ram in July 1939. Two of the batches died out as larvae during the winter months, but some larvae of the other batches moulted to nymphs after 6, 7 or 8 weeks, whereas the remaining ones did so after 48, 50 and 51 weeks [*cf. R.A.E.*, B **20** 274]. In the intervening period,

the ticks remained stored for nearly seven months following the outbreak of war in corked tubes packed in wooden boxes. They were probably subjected to low humidity. This and the low temperatures experienced during the first three months of 1940 were probably the chief factors delaying ecdysis, although the box was kept in the laboratory, where there was a coal fire each day. The nymphs that emerged in June 1940 fed on a hedgehog during the usual period of 4–7 days and were recovered engorged.

The important bearing of the prolonging of the stages during adverse weather on the planning of control measures is emphasised.

CRAUFURD-BENSON (H. J.). **The Cattle Lice of Great Britain. Part I. Biology, with special Reference to** *Haematopinus eurysternus*.—*Parasitology* **33** no. 3 pp. 331–342, 1 map, 17 refs. London, 1941. **Part II. Lice Populations.**—*T. c.* pp. 343–358, 4 figs., 14 refs.

Nearly 85 per cent. of 309 farmers in Great Britain who replied to a questionnaire on the infestation of cattle with lice stated that their cattle were infested, and 52 samples of the biting louse, *Bovicola bovis*, L., and 33 of *Haematopinus eurysternus*, Nitzsch, 16 of *Linognathus vituli*, L., and 4 of *Solenopotes capillatus*, End., all of which are sucking lice, were received. *B. bovis* is the commonest and most widely distributed species, but its economic importance is less than that of *H. eurysternus*. This species appears to decrease from south to north. The records of *L. vituli* were from areas of high rainfall where dairy cattle were most prevalent. *S. capillatus*, which is seldom observed, probably because of its small size, is much more widely distributed than is at present realised. Infestation in the east of Great Britain is in general extremely light; cattle in the hilly areas in the west and the western and midland plains are more severely affected. The eggs of all four species, which are briefly described, are laid near the skin, usually in clusters and sometimes two or more on one hair. The average incubation period for those of *H. eurysternus* varied according to the average minimum temperature from 11 to 16 days; 27·5°C. [81·5°F.] appeared to be the threshold of development. Relative humidities of 0 and 100 per cent. affected the percentage hatch, but intermediate ones did not. The incubation periods of *B. bovis*, *L. vituli* and *S. capillatus* were observed to be 7–10, 10–13 and 10–13 days, respectively. The average length of each of the three instars of *H. eurysternus* was 4 days, and that of the pre-oviposition period 3–4 days. No seasonal variation in these periods was observed. The maximum length of adult life of *H. eurysternus* on the host was 10 days for males and 16 days for females. No adults survived a starvation period of 72 hours at 20°C. [68°F.] and 70 per cent. relative humidity or at 0–10°C. [32–50°F.] and 70–85 per cent. relative humidity; some nymphs survived it under the former conditions, but none survived starvation for 96 hours. Young nymphs were less resistant than older ones. The maximum number of eggs recorded for one female was 24, the eggs being laid at the rate of 1–4 per day. Adults of *B. bovis* failed to survive starvation at 0–10°C. and 70–85 per cent. relative humidity for 144 hours and nymphs for 120 hours.

The second paper contains data obtained in monthly examinations made in 1938 and 1939 on the seasonal variations in cattle lice populations and the distribution of the lice on the animal. Additional

evidence obtained in the questionnaire is included. All four species were most abundant from January to March, and there was a general decrease in April and May. *H. eurysternus* and *B. bovis* began to increase again about September, and it is supposed that the other species do so. Some infestations die out altogether in the summer, while occasional susceptible animals maintain high populations.

It is inferred that high winter populations are associated with dryness of the skin [*cf. R.A.E.*, B **21** 34] arising from poor health as a result of poor quality food, and that rainfall in countries where it is periodic influences louse populations through its effect on the quality of pasture [*cf.* **26** 148]. Apart from this, light intensity is considered to be the most important climatic factor. Of the factors inherent in the host, seasonal fluctuation in the density of the coat seemed the most important. The distribution of the lice on the host was found to vary at different seasons and was related to the thickness of the coat, the lice seeking protection from light in the thick parts. Thickness of coat also regulates the temperature gradient between the skin and the air. The skin temperature rarely fell below 31°C. [87·8°F.] and was between 33 and 36°C. [91·4 and 96·8°F.] on most parts of the body where lice are found. Heifers were susceptible to infestation by all four species, but calves were rarely infested by *H. eurysternus*. Cattle kept in houses were more heavily infested than those in the fields.

BIGHAM (J. T.). *Hippelates* (**Eye Gnat**) **Investigations in the southeastern States.**—*J. econ. Ent.* **34** no. 3 pp. 439–444, 13 refs. Menasha, Wis., 1941.

A survey of eastern Texas, Louisiana, the southern parts of Mississippi, Alabama and Georgia and the whole of Florida was made in September and October 1937 to locate areas where *Hippelates* spp. were abundant, and to ascertain the prevalence of seasonal acute conjunctivitis [*cf. R.A.E.*, B **21** 242]. Almost all the gnats found were *H. pusio*, Lw., and all statements about them refer to this species unless others are mentioned. It was numerous in areas where much of the land was under cultivation and the soil was light (of the sandy or muck type), and prevalence of sore eyes among children was closely associated with its abundance. Traps were operated in large numbers during the spring and summer of 1938 in Alabama, Georgia and Florida. They were baited with a mixture of 2 oz. beef liver cut into small pieces, 1 teaspoonful urea, 1 teaspoonful table salt, and enough water to make 1 U.S. pint. The catches confirmed the conclusions drawn from the preliminary observations, the largest number of gnats, 96,000, being taken in a week in an area surrounded by sandy hills covered with disked citrus groves, and 77,000 and 68,000 in two celery-growing areas, whereas traps in timber or cattle-raising regions never took more than a few gnats, and often none at all. The catches in agricultural areas were sometimes very low during seasons of decreased agricultural activity. Ploughing was immediately followed by increased catches, and a further increase occurred some weeks later, apparently as a result of the breeding that had taken place in the ground.

The use of field recovery cages showed that practically all breeding took place in freshly cultivated soil, oviposition usually occurring within a few hours of the turning of the soil, and almost exclusively within a few days. The number of gnats recovered in cages covering 1 sq. yd.

ranged from 0 to 517. They were not taken in cages that were not over disturbed soil, even though they were within a few feet of ploughed ground from which large numbers were recovered. Occasional individuals of *H. nobilis*, Lw., *H. plebejus*, Lw., *H. proboscideus*, Will., *H. pallipes*, Lw., and *H. dorsatus*, Will., were taken in the traps, and considerable numbers of *H. plebejus* and a single individual of *H. pallipes* in recovery cages. In two experimental plots operated during the autumn and winter of 1938–39, recovery cages set within 24 hours of ploughing usually took about as many gnats as those set two or three weeks later, and cages set in following weeks did not continue to take gnats any longer than the first ones, while those set later still missed the emergence altogether. The presence of the cages did not appear to hasten or retard larval development or affect the total number of larvae reaching maturity. The interval between ploughing and emergence lengthened as the temperature fell, and emergence continued over a longer period. There was some emergence at irregular intervals throughout the winter from land ploughed late in the autumn. Emergence began during the third week after ploughing during summer, and was completed in about two weeks. In further tests made during 1939 and not discussed in detail, as many as 500 individuals were sometimes taken in a single cage covering an area of 1 sq. yd.

A brief account is given of two out of several tests made during the spring and summer of 1939 to investigate possible control measures. One dealt with flooding, which is already commonly practised on seed beds for the control of Nematodes, and the other with levelling and packing with a roller. Both showed promise, particularly the former.

SIMMONS (S. W.) & DOVE (W. E.). **Breeding Places of the Stablefly or " Dog Fly " *Stomoxys calcitrans* (L.) in northwestern Florida.**—*J. econ. Ent.* **34** no. 3 pp. 457–462, 4 refs. Menasha, Wis., 1941.

Stomoxys calcitrans, L., occurs in large numbers from mid-August to mid-October in the coastal area of Florida extending for 400 miles eastwards from the border of Alabama, and seriously affects activities at the seaside resorts and the health of livestock. Investigations on its breeding places were therefore begun in 1939 with a view to developing a method of control. During 1939 and 1940, summer breeding was observed principally in fermenting tidal deposits of *Halodule wrightii* and *Thalassia testudinum* on bay shores, but it does not occur to an appreciable extent in weed that has passed the active stage of fermentation. If vegetation deposited on the beaches is partly inundated by subsequent tides, normal fermentation is prevented and the submerged portions are rendered unsuitable for larval development, but the rows laid down by high storm tides above the normal tide lines are very suitable. In 1940, when there was a total absence of summer storms, *S. calcitrans* was much less abundant than usual, but in 1939, storm tides during August were followed by a major outbreak. Other kinds of marine flora could support breeding if washed ashore in sufficient quantities at a time of adult activity [*cf. R.A.E.*, B **25** 132], but this rarely occurs, and if the layers in which they are deposited are too thin they do not retain sufficient moisture to favour breeding. When newly hatched larvae were placed in a battery jar in a mixture of *T. testudinum* and *H. wrightii* collected two days

previously, and incubated at 32°C. [89·6°F.], pupae were present in five days. Flies emerged after a further five days at room temperature, and laid fertile eggs when 12 days old, some of them living for 22 days. Large infestations developed in 45 piles of green weed of these two species exposed near a cattle corral. Speed of development varied considerably with the temperature and the condition of the medium, the observed period from oviposition to adult emergence ranging from 13 to 116 days, with an average of 20–25 days. The effect of the presence or absence of suitable bays for the production of the vegetation and of beaches for its deposition on the prevalence of *S. calcitrans* in Mississippi, Alabama and Florida is discussed. Ants that carried away the eggs and predacious wasps that destroyed the adults appeared to be sometimes of importance in reducing its numbers.

In late autumn, breeding was observed in fermenting piles of groundnut leaves and stems left in the fields after harvest, 100 larvae and pupae being found per square foot of litter under favourable conditions. Putting pigs to feed on the piles may aid in reducing infestation by mixing dirt with the litter and exposing larvae and pupae to natural enemies and adverse weather, but it cannot be relied upon as a control measure, as the pigs make new openings which may become infested, whereas many mature larvae and pupae are covered only enough to retard the emergence of adults and not to prevent it. Since infestation may be found throughout the piles with the possible exception of the very deep portions, the whole piles must be dealt with, and it is recommended that they should be scattered and ploughed under immediately after harvest. If material has already become infested, it should be scattered thinly and allowed to dry ; it should not be ploughed in, as newly emerged adults can easily push through 4–6 ins. of sandy soil, and one-third normal emergence occurred when pupae were buried 8 ins. deep.

Dahm (P. A.) & Kearns (C. W.). **The Toxicity of Alkyl Secondary Amines to the Housefly.**—*J. econ. Ent.* **34** no. 3 pp. 462–466, 2 graphs, 4 refs. Menasha, Wis., 1941.

As the object of this investigation was to study the relation between the molecular structure of synthetic organic compounds and their toxicity to insects, it was limited to a single homologous series of compounds, the alkyl secondary amines, the toxicity of which is assumed to be largely due to the presence of the secondary amino group, -(NH)-, so that variations in the toxicity of closely related compounds would be due to minor differences in the size and structure of the alkyl groups and not to the introduction of other functional groups that might contribute an additional toxic property to the molecule. The toxicity and rate of toxic action of 22 of these compounds to house-flies [*Musca domestica*, L.] were tested by the " large group " Peet-Grady method [*cf. R.A.E.*, B **26** 244, 245]. The compound N, n-hexyl-n-heptylamine was the most rapidly acting of the straight-chain alkyl secondary amines, as judged by the time required to produce approximately 95 per cent. knockdown, and was more toxic than any lower members of the series, and equal or superior to any of the higher members. Straight-chain alkyl secondary amines with alkyl groups that were identical or differed by only one CH_2 group were more toxic than isomers in which the two alkyl groups differed by more than one CH_2

group. The substitution of branched-chain alkyl groups for one or both of the straight-chain alkyl groups produced a reduction in toxicity and a decrease in the rate of toxic action.

MENG (Ching-hua) & WINFIELD (G. F.). **Studies on the Control of Fecal-borne Diseases in North China. XIII. An Approach to the quantitative Study of the House-frequenting Fly Population. A. The Estimation of Trapping Rates.**—*Peking nat. Hist. Bull.* **15** pt. 4 pp. 317–331, 1 pl., 7 refs. Peking, 1941. **XIV. B. The Characteristics of an urban Fly Population.**—*T. c.* pp. 333–351, 5 graphs, 6 refs.

The numbers of flies caught in traps of various kinds have often been used to estimate relative density [*R.A.E.*, B **24** 279] or the effectiveness of control measures [**25** 55], but the relation between numbers caught and numbers present has not been determined. In the first paper, this relation is studied for two types of standard traps, the tent trap and the Japanese clock trap. Both are illustrated. The former, which is easy to make and is the more efficient, consists of a rectangular wire cage which the flies enter by way of a tent-shaped screenway approach extending up from a solid wooden bottom and opening into the trap by a long slot. A bait consisting of bread saturated with a mixture of 2 gm. brown sugar, 4 cc. vinegar and 4 cc. water is placed under the centre of the approach so that to reach it the flies have to enter the area under the wooden floor. The other trap has a small wooden box rotated by clockwork and smeared with a solution of sugar in glycerine. The flies alight on the rotating box and are carried past an isinglass guard, which prevents their escape except into a small cage. It was adopted as the standard indoor trap because it is small and objection is not usually made to its presence in a living-room.

Information on the composition of the house-frequenting fly population of Tsinan as measured by trapping was given in a previous paper [**26** 145]. The experiments here described, which comprised a preliminary and final series, were carried out in a small, specially constructed house and covered 1,271 trapping hours during the summer and early autumn in 1936 and 1937. Tests were made without extra food and with garbage or bread, sugar and vinegar bait present in the trapping room. A large number of flies was liberated in the room at the beginning of each experiment, and the results are expressed as trapping rates, which show the mean number of flies caught per hour for each 100 flies present. The trapping rates determined in the two series of experiments were significantly different in only 3 out of 12 cases, and in 2 of the 3, the differences were probably caused by improvements introduced in the final series. In view of the fact that the two series were carried out at intervals of a year, and each included daily and seasonal changes for the entire summer, the degree to which the rates coincided is considered remarkable, and it is concluded that the rates show the relation between the mean number caught by a given trap and the number of flies present, and that this relation tends to remain reasonably constant from time to time.

The tent trap had a significantly higher trapping rate for *Musca domestica vicina*, Macq., than did the clock trap under all three conditions as to food supply. The clock trap had a significantly higher rate for *Chrysomyia megacephala*, F., than the tent trap in the presence of

either garbage or bait, and a higher rate in the preliminary tests and a slightly lower one in the final tests with no food in the room. The tent-trap rates for *Muscina stabulans*, Fall., the genus *Sarcophaga*, *Lucilia sericata*, Mg., and the group of miscellaneous species were all significantly higher than the clock-trap rates when no food was present, but in the presence of garbage or bait, the rates did not differ significantly except in the case of the miscellaneous flies in the presence of bait, which were more numerous in the tent trap. The rates for *Musca domestica vicina* were significantly reduced for both traps when either garbage or bait was available in the room. The tent-trap rates for the other species, the miscellaneous group excepted, were all significantly reduced by the presence of these foods, but the clock-trap rates were unaffected. The bearing of the habits of the various species on the rates for the different conditions and traps is discussed. The fundamental difference in the behaviour of indoor and outdoor species suggests that the trapping rates for the latter in the experiments, which were necessarily carried out in an enclosure, may be too low when applied to outdoor stations. Comparative trapping rates for *M. d. vicina* and *C. megacephala* for the two kinds of traps under the three conditions of food supply in both series of experiments are shown in a table. The tent-trap rate for the former was significantly higher than that for the latter under all conditions, probably on account of the reluctance of the outdoor species to enter gloomy areas, but a significant difference was only once obtained in the clock trap ; this was in the final series with no food, when more of *M. d. vicina* were taken. Under all the other conditions, the rate for *Chrysomyia* was slightly the higher.

In conclusion, a table is given showing theoretical trapping rates for the various flies in each trap in the presence or absence of food (garbage or bait). These rates are based on the experiments, with greater weight given to the final series. They have been used in calculating the fly density indices that will be given in the following papers of the series.

The technique used and results obtained when the method described above was applied to the study of the fly population of Tsinan in 1936 are recorded in the second paper. Trapping was carried out from June at indoor stations and April at indoor ones to the end of December. The tent trap was used at outdoor stations and the clock trap at the indoor ones. The numbers of trapping hours, of flies caught and of flies identified at indoor and outdoor stations and at the faeces disposal ground (which is considered separately from the other outdoor stations) and the percentage of the various species are given in a table. *M. d. vicina* formed 52·09 per cent. of the total identified catch and 96·32, 29·12 and 59·30 per cent. of the catches at the indoor and outdoor stations and the disposal ground, respectively. The corresponding figures for *C. megacephala* were 18·31, 2·30, 41·13 and 5·73. Another table shows the general and specific fly density indices, or estimates of the populations present calculated from the trapping rates as described in the first paper and the percentages belonging to each species as calculated from the indices (corrected percentages). The three indoor stations with the highest general density indices all had especially attractive food supplies. The densities in the remaining ones indicated that flies breed more in the villages than in the city. Indices for *M. d. vicina* closely followed the general ones. The general index in the indoor stations was 57·7, and the specific indices for *M. d. vicina* and

C. megacephala were 54·7 and 2·2, the corrected percentages for these two species being 94·7 and 3·81. The highest general density indices outdoors were at a garbage bin and the disposal ground where specially attractive conditions prevailed. The other stations showed the same trend as the indoor ones. The general index at the outdoor stations, excluding the disposal ground, was 532·6, and the indices for *M. d. vicina* and *C. megacephala* were 68·1 and 363·5, the corrected percentages being 12·8 and 68·2. At the only outdoor station within the city and at the disposal ground, *M. d. vicina* was more numerous than *C. megacephala*. The group comprising species other than these two showed greater densities outdoors than indoors, where it was almost negligible. Detailed comparisons of populations in the different stations and districts are made in a further table, and monthly variations are shown in tables and figures. *M. d. vicina* dominated the indoor fly population throughout the trapping period, and its greatest density occurred in July. *C. megacephala* was taken in less than half of the outdoor stations in June and July; its numbers rose rapidly in August, were greatest in September and dropped sharply in October and November, when the last individuals were taken. The findings in an indoor control station in which all flies (1,831) were caught and identified are shown in a table. They corroborated conclusions concerning other indoor stations, 91·77 per cent. of the flies being *M. d. vicina*.

Papers noticed by Title only.

Zumpt (F.). **4. Vorstudie zu einer monographischen Bearbeitung der Stomoxydinae. Ueber einige afrikanische und orientalische** *Stomoxys*-**Arten.** [Fourth preliminary Study for a Monograph on the Stomoxydinae. On some African and Oriental Species of *Stomoxys* (with a catalogue of the subfamily).]—*Z. angew. Ent.* **27** pt. 1 pp. 126–141, 7 figs., 8 refs. Berlin, 1940. [Recd. 1942.]

Takahasi (H.). **Notes on some Species of the Genus** *Culicoides* **from Manchoukuo with Description of a new Species** [*C. buhetoensis*] **(Ceratopogonidae, Diptera).**—*Insecta matsum.* **15** no. 3 pp. 80–85, 2 figs., 2 refs. Sapporo, 1941.

Takahasi (H.). **Description of a new Species of Simuliidae** [*Simulium* (*Odagmia*) *aokii*] **from Nippon, with other Notes.**—*Insecta matsum.* **15** no. 3 pp. 86–88, 1 fig. Sapporo, 1941.

Tokunaga (M.). **Biting Midges from Manchuria (Ceratopogonidae, Diptera)** [including several new species].—*Insecta matsum.* **15** no. 3 pp. 89–102, 1 pl., 7 figs. Sapporo, 1941.

MacLeod (J.) & Craufurd-Benson (H. J.). **Observations on natural Populations of the Body Louse,** *Pediculus humanus corporis* **DeG.**—*Parasitology* **33** no. 3 pp. 278-299, 6 figs., 8 refs. London, 1941.

Summary for 1940.—*Insect Pest Surv. Bull.* **20** no. 10 pp. 559–591, 3 maps, multigraph. Washington, D.C., U.S. Dep. Agric. Bur. Ent. [1941.]

The concluding section (pp. 586–591) of this report on the occurrence of pests in the United States in 1940 deals with those troublesome to man and domestic animals. Data are given on the overwintering and subsequent migration of the screw-worm fly [*Cochliomyia hominivorax*, Coq.]. Infestation of animals by it was very severe in some States, including Oklahoma and Arizona. It is thought that most of the cases in the two principal foci in Florida developed in pigs roaming in the woods, and that lesions caused by the Gulf coast tick [*Amblyomma maculatum*, Koch], which was reported commonly from livestock and occurs in large numbers in the ears of pigs, were the principal predisposing causes [*cf. R.A.E.*, B **28** 243]. The stable fly [*Stomoxys calcitrans*, L.] was unusually troublesome in the south-western States on cattle and pigs. Large numbers of adults appeared on the beaches in western Florida in August, September and December. The September outbreak coincided with emergence from neighbouring marine grass deposits, and the December ones with emergence from ground-nut litter in fields of western Florida, southern Alabama and south-western Georgia [*cf.* **30** 000]. This suggests that the flies are capable of flying much further than was previously believed. Cold weather following the December emergence exercised some control.

Heavy infestations of *Linognathus vituli*, L., were general on cattle, especially in young white-faced cattle in north-western Texas. *Haematopinus eurysternus*, Nitzsch, was exceedingly abundant on individual range animals in the same area, but as usual only some animals were affected while many in the same herd were free of infestation. The winter horse tick, *Dermacentor nigrolineatus*, Pack., is practically confined in Texas to sections of the escarpment of the Edwards Plateau, but during some years it spreads on to the plateau itself and to the north and south of it. It attacks domestic animals, principally horses, between the middle of November and February, infesting the entire body. Several thousand ticks are often seen on a single horse. Heavy infestation causes extensive swelling along the larger veins on the belly, a rapid decline in the health of the animals, and often death if the ticks are not destroyed. The spinose ear tick [*Ornithodoros megnini*, Dugès] increased to such numbers in the Edwards Plateau area, where it was found on 40 per cent. of the sheep and cattle examined, that systematic treatment of the ears of cattle was instituted on many ranches to reduce subsequent infestation by *Cochliomyia hominivorax*. The brown dog tick [*Rhipicephalus sanguineus*, Latr.] was recorded for the first time from Colorado, Minnesota, Nebraska and Tennessee.

A barn in West Virginia was reported to be heavily infested with the human flea [*Pulex irritans*, L.], which has not previously been identified from this State.

Lotze (J. C.) & Yiengst (M. J.). **Mechanical Transmission of Bovine Anaplasmosis by the Horsefly, *Tabanus sulcifrons* (Macquart).**—*Amer. J. vet. Res.* **2** no. 4 pp. 323–326, 1 fig., 14 refs. Chicago, Ill., 1941.

Previous attempts to transmit anaplasmosis of cattle by means of Tabanids are briefly reviewed [*cf. R.A.E.*, B **25** 6; **28** 204, etc.]. It is pointed out that the nature of the agent that causes the disease

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has not been definitely determined and that differences in the results of earlier workers may be due to the condition of the infective material in the source animal. During the summer of 1940, experiments in which the status of the source animal at the time was known were carried out to determine whether *Tabanus sulcifrons*, Macq., could transmit the disease. A susceptible bull was inoculated intravenously with defibrinated blood from a carrier, and anaplasms were first found in its blood 19 days later ; it was then used as the source of infective material in three experiments with *T. sulcifrons*. The experimental procedure is described. Feeding was interrupted for only a few seconds when the fly was being transferred from the infective to the susceptible animal. The condition of the bull at the time of each experiment and essential information on the test animals are shown in a table and discussed. All three test animals developed anaplasmosis 24–28 days after receiving 69–74 bites. One of the experiments was made before the infective animal had developed visible symptoms. None of the control animals developed the disease, even when sick ones were kept in the same stall, and it appears certain that the infection was transmitted by the bites of the flies.

COBBETT (N. G.) & MITCHELL (W. C.). **Further Observations on the Life Cycle and Incidence of the Sheep Bot, *Oestrus ovis*, in New Mexico and Texas.**—*Amer. J. vet. Res.* **2** no. 4 pp. 358–366, 1 ref. Chicago, Ill., 1941.

Details are given of observations on the life-history of *Oestrus ovis*, L., carried out in 1933–36, in connection with investigations on its control, in New Mexico [*cf. R.A.E.*, B **24** 84 ; **29** 78] and Texas. In western Texas, where the winter is moderate, larvae in all stages were found in the head cavities of sheep and were expelled by them all the year round. In north-eastern New Mexico, where the winters are cold, development ceased during the autumn and winter, when infestation consisted chiefly of first-instar larvae that remained quiescent in the nasal passages until spring. The perpetuation of the species is thus assured in areas where the winters are too cold for its survival except in the host. First-instar larvae were normally found only in the nasal passages of the sheep. They migrated to the posterior nasal structures before moulting, and second-instar larvae migrated through the naso-frontal foramina to the frontal sinuses before moulting again. The full-grown larvae retraced this course and left the host through the nostrils. Post-mortem examination of large numbers of sheep in New Mexico and Texas showed that about 96 per cent. were infested, each with 1–75 larvae. The average number of larvae per animal throughout the year was about 20 in New Mexico and 8 in Texas. The heaviest infestations occurred during or immediately after, and the lightest just before, seasons of adult activity. When the larger larvae were present in the frontal sinuses, the number varied from 1 to 25, with an average of 5. Horned sheep were most heavily infested. Adults were active in western Texas throughout the year except in January and February, but in New Mexico only during the warm days of summer and early autumn.

In observations on the development of the larvae in sheep kept in a fly-proof enclosure in New Mexico in 1933, first-instar larvae were readily transferred from gravid females to the nasal passages of experi-

mental ewes and a lamb by pressing them from the abdomen into tepid water, picking them up with a medicine dropper and depositing them in batches of 15–25 in the nostrils. Larvae so deposited at one time did not develop simultaneously. The lamb, which was born in the enclosure and artificially infested on 24th June, expelled six mature larvae between 27th July and 7th September, but still harboured one third-instar, one second-instar and seven first-instar larvae when it was slaughtered on 14th September. All the ewes had been enclosed before the fly season started, but had been exposed to infestation during the previous season. They all expelled mature larvae, and first-instar larvae were found in all when they were slaughtered. These findings were confirmed in observations made in 1934–35 on spring lambs in New Mexico artificially infested on 15th June. Some larvae left the animals after 25–35 days while others remained in the first instar for eight months, and in one case for nine. The last larvae to be expelled by the lambs were collected on 8th May, and only one, an immature third-instar larva, was found in animals killed after that date. No larvae left the hosts between 22nd September and 14th March. Only a small percentage of the larvae placed in the nostrils of the lambs survived to infest their head cavities. Likewise, larvae that were naturally deposited in mature ewes under range conditions in Texas were responsible for continuous infestation for eight months after the sheep were put under observation in fly-proof enclosures in October 1934. Most of the mature larvae were expelled during the autumn and winter months. Ten early spring lambs confined in a fly-proof enclosure in New Mexico in 1936 before the beginning of the fly season and artificially infested on 9th June, were killed in pairs at weekly intervals. The larvae remained in the first instar in the nasal passages during the first week, some moulted to the second instar, and a few migrated to the frontal sinuses during the second week, these moulted to the third instar and developed rapidly during the third week, some apparently reaching maturity, and additional third-instar larvae of various sizes were present in the frontal sinuses during the fourth and fifth weeks. A mature larva was expelled by one of the remaining lambs at the end of the fifth week. Other larvae remained in the first instar throughout the five weeks.

The time that 76 mature larvae observed in New Mexico in 1933 required to pupate varied from about 24 to 128 hours, the average time being about 51½ hours for 34 expelled during May and June, and about 70 hours for 42 expelled during April and August. During the summer and early autumn of 1934, mature larvae were allowed to pupate in soil in screened coops out of doors in New Mexico. The weather was warm until mid-August and then became increasingly cooler. Emergence practically ceased after mid-September, though four adults were obtained between 17th September and 31st August. Adults were obtained from 87 per cent. of the larvae that matured before 25th July and only 21 per cent. of those that matured later, while the periods required for transformation and emergence were 24–30 days during the warm weather and 27–62 days for flies that emerged after mid-August. Adults that emerged during the warm weather were very active and lived for an average of only 1½ days in captivity, while those that emerged at lower temperatures were correspondingly less active and lived for an average of eight days. The number of eggs in 18 females examined was found to vary from 337 to 652, with an average of about 500, so that one female may infest a large number of sheep.

Smith (C. N.) & Cole (M. M.). **Effect of Length of Day on the Activity and Hibernation of the American Dog Tick,** *Dermacentor variabilis* **(Say) (Acarina : Ixodidae).**—*Ann. ent. Soc. Amer.* **34** no. 2 pp. 426–431, 4 refs. Columbus, Ohio, 1941.

Larvae and adults of *Dermacentor variabilis*, Say, hibernate in large numbers and nymphs in varying numbers on the island of Martha's Vineyard, Massachusetts, practically no ticks being found on meadow mice [*Microtus*] and deer mice [*Peromyscus*] from October to March, but hibernation of larvae and nymphs in the neighbourhood of Washington, D.C., is less complete, although that of adults is complete in both localities. Meteorological data from the island and laboratory observations show that temperature is not the factor that induces hibernation. As the season of tick activity extends roughly from 21st March to 21st September and the factor that these dates have in common is the length of daylight (photoperiod), the effect of the length of this period on the activity of the ticks was investigated in the autumn and winter of 1938, and between 20th September 1939 and 2nd March 1940, one set of ticks being exposed to normal daylight and a similar one to artificially extended light periods.

The following is from the authors' summary of the results. Larvae and nymphs exposed to lengthening artificial photoperiods corresponding to those of 24th March to 21st June engorged much better than those exposed to the normal, decreasing photoperiod from 20th September to 18th December, even with slightly higher temperatures in favour of the latter. When the artificial photoperiod passed its peak and began to decrease, corresponding to the shortening days of July, the difference between the behaviour of larvae and nymphs exposed to it and of those exposed to the normal photoperiod of the lengthening days of January was not so great, and by 8th February, those exposed to normal, increasing daylight engorged better than those exposed to the greater but decreasing photoperiod equivalent to that of 12th August. Those in the normal daylight were exposed to a slightly higher temperature. The increased photoperiod had no effect on the activity of adults during either winter.

Chagnon (G.). **The Cockroach** *Supella supellectilium* **(Serville) in Quebec (Orthoptera, Blattidae).**—*Canad. Ent.* **73** no. 6 p. 104. Guelph, Ont., 1941.

Numerous adults, nymphs and egg cases of *Supella supellectilium*, Serv., were found in a house in Montreal in November 1940. This is the first record of this cockroach from Quebec and probably from Canada.

Mills (H. B.) & Pletsch (D. J.). **Another Infestation of a School Building by** *Oeciacus vicarius* **Horvath.**—*J. econ. Ent.* **34** no. 4 p. 575. Menasha, Wis., 1941.

In May 1940, a school in north-western Montana, which was being temporarily used after being vacant for five years, was found to be infested with *Oeciacus vicarius*, Horv. [*cf. R.A.E.*, B **29** 135], and some of the pupils stated that they had been bitten by the bugs. There were several cliff-swallows' nests beneath the eaves. One bug that was given daily opportunities to feed on man from 11th June did

so on that date and twice on 15th. It refused to bite the first host offered. The bites caused no irritation, and only one produced as much pain as a light pin-prick.

MALLIS (A.) & PENCE (R. J.). **The Pacific Drain Fly in Homes.**—*J. econ. Ent.* **34** no. 4 pp. 586–587, 2 figs., 5 refs. Menasha, Wis., 1941.

In the western United States, adults of *Psychoda pacifica*, Kincaid, often emerge in spring from the waste pipes of sinks and baths, and it is believed that an infestation of a sink pipe observed in California was encouraged through the use of large amounts of soap. After 6 or 7 adults had been observed to emerge from it, the part of the pipe including the water-seal was dismantled, and a gelatinous material was found adhering to the inner wall. The portion of this material from the water-free section of the pipe contained 5 larvae, 6 cast skins and 1 pupa. The immature stages are resistant to hot water and many poisonous and caustic substances while in the gelatinous material. Control was effected by forcing the material out of the pipe with a swab coated with wax paper. Considerable time has to elapse before the lining accumulates again in sufficient quantity to permit breeding.

HIXSON (H.). **A Suicide Host.**—*Florida Ent.* **24** no. 2 p. 34. Gainesville, Fla., 1941.

Two individuals of the blue-tailed skink (*Plestiodon fasciatus*) collected near Gainesville, Florida, in early May 1939 were found to be infested with 123 larvae and 8 nymphs of *Ixodes ricinus scapularis*, Say, all of which were alive and in various stages of engorgement. Seven fence lizards (*Sceloporus undulatus*) collected at the same time were infested with 42 larvae and 6 nymphs of the same tick, but in this case 34 of the larvae and 5 of the nymphs were dead and some of the others were apparently moribund.

HASEMAN (L.) & ROLAND (W. E.). **Controlling Bot and Warble Flies of Livestock in Missouri.**—*Bull. Mo agric. Exp. Sta.* no. 430, 32 pp., 15 figs., 12 refs. Columbia, Mo., 1941.

This bulletin, which is intended for the use of farmers in Missouri, deals briefly with the morphology, life-history, seasonal incidence in the State, economic importance and control of the six species of Oestrids that occur there in domestic animals, viz.: *Gastrophilus intestinalis*, DeG., *G. nasalis*, L., and *G. haemorrhoidalis*, L., in horses, *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., in cattle and *Oestrus ovis*, L., in sheep.

NELSON (F. C.). **Cattle Spray Testing.**—*Soap* **17** no. 8 pp. 92–97, 119, 121, 1 fig., 76 refs. New York, N.Y., 1941.

A list of references is given to papers dealing with types of tests for sprays against flies on cattle, together with summaries of the methods in most general use, some of which have already been noticed [*R.A.E.*, B **21** 110; **23** 167; **27** 250; **28** 240]. They are divided into three groups: field tests for evaluating repellency and toxicity, laboratory tests for evaluating toxicity, and laboratory tests for evaluating repellency.

Attention is drawn to the objections to some of them, particularly the laboratory methods for testing repellency, which are unsatisfactory because results obtained on house-flies [*Musca domestica*, L.] do not always correspond with field results on blood-sucking flies, such as *Lyperosia* (*Haematobia*) *irritans*, L., *Stomoxys calcitrans*, L., and Tabanids, which are the important pests of livestock and are difficult to repel, but are not easy to rear and do not respond normally in the laboratory. It is concluded, therefore, that repellency studies must be carried out in the field.

The methods summarised include a field one successfully used by E. M. Searls and F. M. Snyder, in which one side of each of a group of cows is sprayed and the other side left as control, and another group left entirely unsprayed as alternate control. The method of calculating the results is given, the percentage repellency being the average of the repellencies observed when the untreated sides and untreated cows are used as controls. In the Whitmire laboratory method of testing repellency, an attempt is made to simulate natural conditions by using 3 inch squares of deer or calf skin tanned with the hair on. Sugar is rubbed into the squares, and, in each test, one sprayed and one unsprayed square are placed at opposite ends of a cage containing 250–300 flies. At intervals of 30 minutes after introduction, the number of flies on the sprayed skin, the number on the unsprayed skin, the number affected but walking and the number unable to walk are recorded.

A method that permits of all materials to be compared being tested concurrently under natural conditions is described from a report by Searls. As many cows as there were insecticides to be tested were taken at random from a herd and distinctively marked, and one spray was applied to each cow daily at 5.30 a.m. for a week. In subsequent weeks, the cows received different sprays until each had been treated with every spray. Four other cows were used as unsprayed controls throughout the experiment, and a fifth was sprayed with the same amount of base oil as that applied to the test animals. No spraying was done on Sundays to allow all residues to dissipate. After being sprayed, the cows were turned out to pasture with the rest of the herd. Counts were made five times before the cows were brought in for milking at 3 p.m. The results were shown by determining the geometric means of the actual counts plus 1 for each hour for each material against each species of fly throughout the experiment. The comparative value of the different materials was determined by computing the minimal significant difference between materials for each hour against each species. The advantages of this method are pointed out.

Goodhue (L. D.) & Sullivan (W. N.). **Insecticidal Smokes. Their Application in the Control of Household Insects.**—*Soap* **17** no. 8 pp. 98–100, 3 figs., 6 refs. New York, N.Y., 1941.

The application of an insecticide as a smoke makes possible the use as fumigants of non-volatile or slightly volatile materials [*R.A.E.*, B **29** 44]. It has recently been shown that the smoke or aerosol can be produced more economically by spraying solutions of the insecticide on a hot plate than by burning [**28** 239]. A description is given of a dispersing apparatus for use in large enclosures when considerable capacity is required. The solution is fed into a revolving perforated cup, which throws the spray against the side wall of a cylinder heated

to 400°C. [752°F.], and the dispersion is carried away by a blast of air passing through a venturi tube in the head of the cylinder. Besides plant insecticides, many synthetic compounds with vapour pressure too low for them to be used as fumigants in the ordinary way are easily dispersed by this method. Brief reference is made to experiments, an account of which is being published, in which the toxicity of naphthalene was increased many times when it was vaporised in the presence of the non-toxic smoke of maize stalks which provided a support for it. The addition of oleic or lauric acid to orthodichlorobenzene greatly increased kill [**30** 37]. This effect may be attributable to the dense smoke they produce or to a synergistic action. Not all fatty acids have the same effect although they produce smoke. Orthodichlorobenzene containing 5 per cent. lauric acid used at the rate of 1·5 lb. per 1,100 cu. ft. gave complete kill of the American cockroach [*Periplaneta americana*, L.], the German cockroach [*Blattella germanica*, L.], the bed-bug [*Cimex lectularius*, L.] and the confused flour beetle [*Tribolium confusum*, Duv.]. The suitability of a large number of synthetic compounds to be applied as aerosols was examined. Some of the most toxic to house-flies [*Musca domestica*, L.] and cockroaches are named. Orthodichlorobenzene containing oleic acid or some similar activator appeared to be the most practical. It is a good solvent for certain other insecticides, which can be added if necessary for extremely resistant insects.

Campbell (F. L.), Barnhart (C. S.) & Hutzel (J. M.). **Tests on crawling Insects. Evaluating liquid Household Insecticides against the German Cockroach and Bedbug—a final Report on Research Project at Ohio State University.**—*Soap* **17** no. 7 pp. 105–107, 109, 111, 113, 115 ; no. 8 pp. 105, 107, 109, 111, 113, 115, 121, 13 figs. New York, N.Y., 1941.

This final report on work that has been in progress in Ohio since 1937 on methods of testing the effectiveness of liquid household insecticides (fly-sprays) against crawling insects comprises accounts of technique for rearing stocks of the German cockroach [*Blattella germanica*, L.] and the bed-bug [*Cimex lectularius*, L.], which has already been noticed [*R.A.E.*, B **28** 54], and descriptions of three methods of testing insecticides against them. The first of these is the settling mist method [**27** 18], which has been used in the laboratory since 1939, pending the adoption of an official test method. The procedure followed with both cockroaches and bed-bugs is given. The second, which is called Barnhart's lard can method, consists in spraying the liquid downwards on to the perforated lid of a small box containing the cockroaches, which stands at the bottom of a cylinder with a glass top. Many of the cockroaches, some of which are hit by the spray while still in the box, are driven out and subjected to the effect of the settling mist and residue. If it is desired to take the fumigating effect of the vapour from the residue into consideration, the cylinder can be covered with a tight-fitting lid during the observation period. Data are provided on two aspects of the action of the spray, drive-out and kill. The third method, Hutzel's chamber method, ignores drive-out but emphasises the effect of direct spray and makes use of a Peet-Grady chamber and atomiser [**16** 255]. The cockroaches or bed-bugs are exposed in dishes arranged in a spiral on the floor of the chamber so

that the dose received in the various dishes decreases from the centre of the chamber outwards. This is the situation in the practical control of crawling insects, where the degree of control depends on the position of the insects with respect to the spray as well as on the potency of the insecticide. The merits of the three methods are compared, and the adoption of either the first or the last is recommended. The lard can method is rejected because it is considered that its principal feature, measurement of drive-out, is unnecessary for a routine test, and it requires too much time and space and is not suitable for tests against bed-bugs. The settling mist method, which is preferred, is rapid and precise, requires little space and gives results that are in line with practical expectations. The advantage of the chamber method, which is slower and mechanically less precise, is that most of the equipment required is already available in many laboratories.

ANGEVINE (W. K.). **Pyrethrum Ointment. A Report on its Use in the Control of Lice and Scabies.**—*Soap* **17** no. 8 pp. 117, 119. New York, N.Y., 1941.

During the period 1st December 1940–12th April 1941, more than 22 per cent. of the 6,676 prisoners admitted to the District of Columbia jail were found to be infested with lice, predominantly *Pediculus humanus*, L. (*corporis*, DeG.), and more than 4 per cent. with *Sarcoptes scabiei*, L. The use of a pyrethrum preparation as an ointment is considered the most efficient and suitable way of controlling lice and mites in institutions. The ointment must be easy to apply and to remove with soap and water, and must not decompose rapidly or cause dermatitis. Pyrethrum concentrates on the market were found to be chemically or dermatologically unsuitable, and were rejected in favour of the residue left after the pyrethrinated oleoresins are extracted by the cold process. The unrecovered pyrethrins in the residue left from carefully selected flowers will assay at about 6 per cent. Patch tests indicated that the pyrethrum allergen was in the resinous content, which is almost entirely removed in extraction by the cold process, and tests with the residual jelly confirmed this. The fact that pyrethrins are rapidly decomposed by hydroxides, actinic light and oxidising materials was considered in the preparation of an ointment so that the carrier as well as blending homogeneously would be synergistic with the pyrethrum jelly. The only suitable medium found was a petrolatum with a high melting point, in which many of the olefines had been distilled off. The resulting ointment has a solvent action on the substance by which louse eggs are fixed to hair. Of many materials tested to prevent the remaining allergic substances from entering the lymphatic circulation, the best was crystalline dimethyl methylene ether of allyl tetroxybenzene, and an ointment termed A-200 Compound in which it was included was prepared. All patch tests with this ointment gave negative skin reactions after 24 and 48 hours, while 20 per cent. of the control tests made with petrolatum pyrethrinated 2 per cent. with commercial oleoresin of pyrethrum flowers gave positive reactions after 24 hours and 40 per cent. after 48 hours. One application of the ointment, which kills lice in a few minutes and is toxic to their eggs, eliminated infestation in all of the 1,504 cases in which it was tested, and three applications cleared up the most severe conditions in 279 cases of pustular and non-pustular scabies.

Watson (R. B.) & Maher (H. C.). **An Evaluation of Mosquito-proofing for Malaria Control based on one Year's Observations.**—*Amer. J. Hyg.* **34** (C) no. 2 pp. 86–94, 2 graphs, 8 refs. Lancaster, Pa., 1941.

It is concluded from a review of previous work that most of the studies that apparently demonstrated the effectiveness of mosquito-proofing of houses as a measure against malaria were incomplete. Investigations were therefore designed to obtain more precise data and incidentally to provide information on the epidemiology of malaria in the Tennessee Valley. The area chosen was in northern Alabama near a lake where *Anopheles quadrimaculatus*, Say, bred in large numbers and attempts to protect the population by control of breeding had proved expensive and ineffective. Larvicidal measures were nevertheless continued in 1938 during the period under observation, when data were collected from 98 proofed and 45 non-proofed houses. The methods of collecting and analysing the data are described, and it is concluded that the statistical method used to evaluate effectiveness appears to be rational. The findings indicated that mosquito-proofing gives considerable protection against malaria, but definite conclusions cannot be drawn as the population groups involved were too small and the incidence of malaria in the control houses may have been influenced by the proximity of the proofed ones. Moreover, the protective value of mosquito-proofing may not be fully manifest in the first year. It is concluded that the findings justify the extension of these studies and their continuation under more controlled conditions, and it is particularly recommended that the experience in proofed houses be followed up in subsequent years and that the effectiveness of proofing in the absence of any other measure be examined.

Kiker (C. C.) & Breedlove (H. E.). **Mosquito-proofing for Malaria Control from the Standpoint of Construction Costs.**—*Amer. J. Hyg.* **34** (C) no. 2 pp. 95–101, 4 figs., 3 refs. Lancaster, Pa., 1941.

The cost of mosquito-proofing about 350 houses in the Tennessee Valley, Alabama, in 1938 and 1939 was found to average 33 dollars per house. The feasibility of having the work done by contract under the circumstances described is demonstrated. The mosquito-proofing was being tested as a substitute for larvicidal operations, because of the impossibility of immediately controlling *Anopheles quadrimaculatus*, Say, in the areas under consideration. It was made as complete as possible and included screening doors and windows, closing cracks in floors, walls and ceilings with asphalt roofing paper, kraft paper, or strips of tin or wood, sealing fireplaces with a removable screen and screening porches. The work has not been completed sufficiently long for data to be available on maintenance costs.

Smith (G. E.), Watson (R. B.) & Crowell (R. L.). **Observations on the Flight Range of *Anopheles quadrimaculatus*, Say.**—*Amer. J. Hyg.* **34** (C) no. 2 pp. 102–113, 1 fig., 1 map, 9 refs. Lancaster, Pa., 1941.

The very large expanse of impounded water that is being formed in the Tennessee Valley, in northern Alabama, will provide breeding places for *Anopheles quadrimaculatus*, Say, in a region in which malaria

has been endemic for many years. Previous work had indicated that this mosquito is active for up to one mile from a breeding place [*R.A.E.*, B **5** 134; **8** 64; **12** 56], but as its flight habits in the Tennessee Valley might not be the same as they are elsewhere, a study of the subject was undertaken during 1936. Stained mosquitos were liberated from a bridge on an impounded tributary of Lake Wilson on eight days between 15th June and 8th August, and every likely accessible resting place within 1¼ miles was inspected daily. Six out of 3,800 mosquitos released were recovered between 17th June and 8th July, but none later. They were recovered at distances of 2,700, 1,050, 675, 675, 600 and 375 ft. from the point of release. A constant supply of blood was available within 1,000 ft., but both the mosquitos recovered at a greater distance were females, as were two of the others. About two-thirds of the 415 unstained females taken were within 1,000 ft. and about four-fifths within half a mile of known breeding places; it is thus concluded that dispersion varied with distance from the place of emergence and that under the prevailing conditions of light natural breeding and abundant contiguous blood supply, the greatest proportion of the insects dispersed over an area with a radius of half a mile.

During 1934–38, blood-films from persons living in some 900 houses scattered more or less uniformly over the area within a mile of Lake Wilson were examined for malaria parasites. Positive results were obtained from 145 houses, and 104 of these were within 3,000 ft. of the shore of the lake, while only 2 were more than 5,000 ft. distant. Collections of females made in 1937 within two miles of a large natural pond where mosquito production was moderate, in a sector in which all production in secondary breeding places was controlled, fell off regularly as distance from the pond increased, but some individuals were collected more than a mile from it. Endemic infections among the population, which is evenly distributed in the zone, appeared to be associated, broadly at least, with the observed densities of the vector. An epidemic of malaria occurred in August–September 1937 in an area in which a prolific breeding place had been formed by impounding water early in the year and in which very little malaria and very few mosquitos had existed previously. The parasite indices in dwellings less than 3,000 ft., between 3,000 ft. and one mile and more than one mile from the impounded river were 23, 8 and 7 per cent., respectively, in October 1937. In August 1938, relatively heavy density of *A. quadrimaculatus* within 3,000 ft. of the river was again evident, the distribution being essentially the same as that of the malaria parasites in 1937. It is considered that these surveys strengthen the hypothesis that a mile is the limit of the flight range of *A. quadrimaculatus* under conditions of heavy infestation, and that transmission of malaria is greatest within 3,000 ft. of breeding places when sources of blood are available throughout the area.

KOMÁREK (J.) & BREINDL (V.). **Das heutige Verhältnis *Anopheles*-Tier-Mensch in Mitteleuropa.** [The Complex *Anopheles*-Animal-Man in Central Europe to-day.]—*Z. angew. Ent.* **28** pt. 2–3 pp. 501–506. Berlin, 1941.

Surveys in Bohemia and Moravia in 1940 showed that *Anopheles maculipennis*, Mg., var. *typicus* occurred sporadically throughout the region but was more common in the hills than in the lowlands, and that

A. m. messeae, Flni., was numerous in summer in well watered plains and in river valleys. *A. claviger*, Mg., was limited to Bohemia, where it was common in late summer and autumn in the lowlands of the Elbe and Moldau and occurred up to about 3,000 ft.

The authors state that these Anophelines fed indiscriminately on man and any available domestic animals. They were abundant in village cowhouses and almost completely absent from adjoining bedrooms, but this was due, not to a preference for the blood of the cattle, but to the microclimate resulting from the warmth and moisture produced by these animals in the dark, dirty, ill ventilated and very warm cowhouses of the peasantry. They did not occur in the cowhouses on large estates, which are airy, light and clean, and have whitewashed walls.

It is concluded that these Anophelines are becoming semi-domesticated, and that the adults tend to disappear from the field and to collect in villages. Larvae were found in breeding places near villages, but not in apparently favourable ones at a distance from them. A newly emerged female seeking food is guided by the strong smell of cattle in the village, where access to cowhouses is easy whereas bedroom windows are shut at night and the microclimate of the entrance to a dwelling is unattractive. The presence of many males in cowhouses points to a search for shelter, not food.

KEMPER (H.) & REICHMUTH (W.). **Die Taubenzecke als Parasit des Menschen.** [The Pigeon Tick as a Parasite of Man.]—*Z. angew. Ent.* **28** pt. 2–3 pp. 507–518, 18 refs. Berlin, 1941.

In a previous paper, Kemper recorded four cases of adults of the pigeon tick, *Argas reflexus*, F., attacking man in houses in Germany [*R.A.E.*, B **23** 46]. Since then at least two dozen such cases have been reported, mostly from Berlin. In this paper, the authors review the literature on the effect on man of the bite of the tick and describe the effects on themselves of several such attacks in the laboratory. In the case of one of the authors, the skin reaction disappeared in a few hours, but in the other the after effects persisted for a year or longer. It is considered that the ticks could not maintain themselves for long in human habitations, and there is some evidence that a constant diet of human blood does not generally suffice for normal egg-maturation.

STAPLES (R. R.). **Anti-tsetse Clearing and Land Use.**—*E. Afr. agric. J.* **7** no. 1 pp. 48–50, 10 refs. Nairobi, 1941.

It has frequently been assumed that clearing land of its bush and tree growth as a means of controlling tsetse flies (*Glossina*), as has been largely done in Tanganyika Territory, encourages soil erosion [*R.A.E.*, B **28** 24] and decreases soil fertility and water supply. In this paper, it is pointed out that on the contrary, under the semi-arid conditions of eastern Africa, bush clearing decreases erosion, which is particularly bad in wooded grazing areas because the ground vegetation is thin and annual and numerous footpaths are formed on account of obstructions ; grass ley may be as good as or even better than bush ley in restoring soil fertility after cultivation ; and clearing undoubtedly improves the carrying capacity of the land, while there is reason to expect its effects on water supply to be beneficial. It is concluded that bush clearing is not only an effective anti-tsetse measure, but is also probably essential to the full use of the land for mixed farming.

HORNBY (H. E.). **Pasture Management in Relation to Tsetse Reclamation.**—*E. Afr. agric. J.* **7** no. 1 pp. 51–55. Nairobi, 1941.

The following is substantially the author's summary. Although overstocking is the cause of much soil erosion in eastern Africa, livestock in correct concentration is necessary for the full agricultural development of any area. Freeing the land from tsetse flies (*Glossina*) or the imminent threat of invasion by them is thus an essential agricultural measure. The usual method of reclaiming land from tsetse is bush clearing designed to reduce the factors essential for the fly to below the minimum necessary for survival. Much of the failure of reclamation work in the past has been due to failure to realise that sporadic effort is not sufficient, that sustained clearing and farming operations involving the whole of the area are necessary, and that pasture must be regarded as a crop requiring labour for its maintenance. Grassland is ordinarily maintained by fire, and when it is converted into pasture and fire is excluded, it can be maintained only with the aid of weeding. As uncontrolled grazing leads to lowered carrying capacity and often to soil erosion, barrier clearings for the sole purpose of protecting areas from fly may not be justified if the areas are badly farmed. Raising the standard of animal husbandry is an important form of protection against tetse. Trypanosomiasis was very serious at the Government Farm at Mpwapwa, Tanganyika, as long as the herds were allowed to search for their food in the woodland, but ceased to be of importance when the grazing area was cleared of thicket and planted with grass ; and the carrying capacity of the area was raised many times by the reclamation. A system in which cattle are pastured more and more on artificially prepared grassland is necessary in the presence of tsetse and highly desirable in its absence. It is recommended that a scheme be extended by which the whole of Tanganyika Territory would become sharply divided into man-and-stock areas free from tsetse in which game is not protected by law and game-and-tsetse areas used as little as possible for agriculture, and in which game is adequately protected.

FINDLAY (G. M.). **The present Position of Yellow Fever in Africa.**—*Trans. R. Soc. trop. Med. Hyg.* **35** no. 2 pp. 51–76, 2 maps, 18 refs. London, 1941.

Yellow fever is now known to occur in Africa from the southern borders of the Sahara to the Belgian Congo, and from the West Coast to the Anglo-Egyptian Sudan and Uganda. The area in which positive results have been obtained by immunity surveys [*cf. R.A.E.*, B **24** 296, etc.] is only slightly more extensive than that in which cases have been demonstrated. Isolated cases are often recorded as well as epidemics. Instances are given of urban and rural epidemics and rural endemicity, and the transmission of the rural forms is discussed. Rural endemicity is a term used to cover the occurrence of isolated cases and also that of small communities showing low rates of immunity in the absence of any known epidemic. The most striking African rural epidemic is the one that recently occurred in the Sudan [**29** 115], but much smaller ones were observed in the Gold Coast in 1933 and 1937. There is no evidence that *Aëdes aegypti*, L., was not a vector in all of them, though other mosquitos may have played an accessory part. Rural endemicity might be maintained by a

mosquito-man or a mosquito-animal cycle. Since 1936, various workers have examined the sera of over a hundred apes and monkeys caught in endemic areas and found immune bodies in 19·5 per cent. of them. The sera of a small number of other wild animals examined were all negative. Among domestic animals, 25 of 166 cows, 27 of 121 sheep and goats, 3 of 6 horses, 3 of 11 pigs, 3 of 5 camels, 3 of 9 dogs, 1 of 2 ostriches and none of 20 hens were positive, but the full significance of these findings is not known. The possibility of the virus being preserved for long periods in either a vertebrate or an invertebrate host is discussed.

The kinds of transport that may carry infected persons or mosquitos to previously uninfected districts and the methods of preventing their doing so are reviewed. The methods considered for the control of epidemics and prevention of their spread are accurate and early diagnosis, immunisation, and the destruction of mosquitos, supported when necessary by administrative measures. Essential preliminaries to the destruction of mosquitos are adequate surveys of the breeding places of *Aëdes aegypti* and potential vectors, the preparation of an accurate *Aëdes* index and the provision of an adequate water supply.

In the discussion that followed, H. H. Smith, speaking on yellow fever in South America, stated that it had been ascertained in a study of the epidemiology of the disease in Colombia made since 1933 that it recurs in the same narrow valleys, even after intervals of 2–5 years and frequently within a few hundred yards of where it was found previously. The virus was isolated eight times between November 1940 and February 1941 from wild bush mosquitos of the genus *Haemagogus* taken in the Villavicencio area.

Woodman (H. M.) & Bokhari (Ahmed). **Studies on *Loa loa* and the first Report of *Wuchereria bancrofti* in the Sudan.**—*Trans. R. Soc. trop. Med. Hyg.* **35** no. 2 pp. 77–92, 23 refs. London, 1941.

Though filariasis has long been known in the Anglo-Egyptian Sudan, it is only in the last ten years that an attempt has been made to determine the filariae involved and the effect of each on the health of the indigenous population. *Filaria* (*Acanthocheilonema*) *perstans*, which is considered quite harmless, *Onchocerca volvulus*, which causes important lesions [*R.A.E.*, B **23** 134] and *F.* (*Loa*) *loa* are well known throughout the Equatorial Province. First studies of *F. loa* in the southern part of the Province disclosed that certain morphological features of the microfilaria, its periodicity and clinical phenomena did not seem to conform to the account of the West African variety, and that, of the species of *Chrysops* stated to be vectors in Nigeria [**10** 184] only one, *C. silacea*, Aust., had been found in the area of observation, and that in only one corner of it. Lesions familiar in association with *F.* (*Wuchereria*) *bancrofti*, which had not been found in the Sudan, were fairly common in areas in which *F. loa* occurred, and though *O. volvulus* could have caused them in some parts, it was extremely rare in others. It was therefore considered possible that these phenomena were attributable to *F. loa* and investigations were made accordingly. A clear instance of infection with *F. bancrofti* was demonstrated after more than 1,500 films of day and night blood of cases showing sheathed microfilariae had been examined, and some dozen cases were later found in 1937 and 1938, but this species was not found in association

with elephantiasis and hydrocele and *O. volvulus* was very rarely so observed. This is thought to afford some justification for attributing at least the earliest stages of lymph varix to *F. loa*, and attention is drawn to a possible association between the latter and the disposition to hernia and hydrocele. The morphology and periodicity of the microfilaria, its reaction to drugs, and the symptoms observed are discussed.

C. distinctipennis, Aust., was much the commonest species of *Chrysops*; it was evenly distributed throughout the western two-thirds of the district and occurred at all seasons. *C. longicornis*, Macq., was comparatively uncommon; and *C. silacea* was taken in appreciable numbers in one year only, in the rainy season, but it appeared to be rather more aggressive than the other two species, which were furtive and seldom attacked man. All three were chiefly associated with cattle. Dissection of 600 wild individuals of *C. distinctipennis* revealed the presence of embryos of *F. loa* in 4, and the course of the development of the embryo studied in 300 dissections of experimentally fed flies is outlined. Development took place on the lines described by Connal & Connal [**10** 42] but was slower, requiring 12–16 days or more, and was often irregular. In an attempt to ascertain whether flies of other genera could act as vectors, three species of *Haematopota*, two of *Stomoxys* and two of *Glossina* were caught, artificially fed and dissected. Results with the last four (20 individuals of each) were entirely negative, and none of the 40 *Haematopota* showed embryos of more than seven days' development. The possibility of development in Diptera of other families is briefly discussed.

Two varieties of unsheathed microfilariae were found in a common dove and another in a parrot.

LLOYD (Ll.). **The seasonal Rhythm of a Fly** (*Spaniotoma minima*) **and some theoretical Considerations.**—*Trans. R. Soc. trop. Med. Hyg.* **35** no. 2 pp. 93–104, 4 graphs, 6 refs. London, 1941.

A study of the numbers of *Spaniotoma minima*, Mg., trapped in sewage beds at Leeds showed peaks of emergence throughout the year that occurred at shorter intervals than would be required for the development of successive generations. On the basis of the temperature of the environment, thermal constant and threshold of development, the theoretical life-cycles were timed for each week from September 1937 to April 1941, and superimposed on the charts of incidence, and it was found that peak periods of output were caused by several series of generations running simultaneously. It is shown by a theoretical case in which calculations are begun from a uniform population that a succession of parallel generations must be produced by the effect of sudden changes in temperature, though for the same reason some of them subsequently merge into others. It seems inevitable that this mechanism must occur in the case of an insect in which the rate of development depends solely on temperature, and that it serves, as the diapause does in other insects, to reduce the likelihood of extermination by unfavourable weather. *S. minima* requires fairly mild calm weather for the mating dance [*R.A.E.*, B **26** 113]. A single flight might be unable to achieve mating through meeting a cold stormy period, but it is unlikely that the whole local race will be unable to mate if emergence is divided into a series of peak periods.

ZUMPT (F.). **Ueber neuere Untersuchungen zur Rolle der Bettwanzen als Krankheitsüberträger. Mit einem Beitrag zur Terminologie der Krankheitsübertragung durch Tiere.** [On recent Investigations on the Rôle of Bed-bugs as Vectors of Disease. With a Contribution to the Terminology of Disease Transmission by Animal Organisms.]—*Zbl. Bakt.* (I. Ref.) **136** no. 19–20 pp. 401–414, many refs. Jena, 1940. [Recd. 1942.]

This review of the literature brings a previous one [*R.A.E.*, B **13** 22] up to date. It is concluded that bed-bugs (*Cimex lectularius*, L., and *C. hemiptera*, F.) are of little or no importance as vectors of disease, except possibly in the case of the Minas Gerais strain of Brazilian exanthematic typhus [**23** 148].

BLANC (G.) & BALTAZARD (M.). **Transmission du bacille de Whitmore par le moustique** *Aëdes* (*Stegomyia*) *aegypti*.—*C. R. Acad. Sci.* **213** no. 19 pp. 670–672, 1 ref. Paris, 1941.

An account is given of further investigations on the transmission of Whitmore's bacillus by blood-sucking insects [*cf. R.A.E.*, B **30** 51] in which 50 females of *Aëdes aegypti*, L., caged under humid conditions with males and allowed to feed during eight days on infected guineapigs transmitted the bacillus to healthy guineapigs on which they were subsequently allowed to feed. A suspension of the 14 females that were still alive 21 days after the beginning of the experiment caused the infection when inoculated subcutaneously into a healthy guineapig, but a suspension of the larvae that hatched from eggs deposited in the cage did not.

JORDAN (J. H.) & SILVEY (W. J.). **The comparative Value of Phenothiazine, Paradichlorbenzene, Tetralin, Trichlorethylene and Pyrethrum Extracts as Mosquito Larvicides.**—*Chin. med. J.* **60** no. 1 pp. 66–72, 3 refs. Peiping, 1941.

In view of the limitation of supplies of pyrethrum extracts, the value of a large number of possible substitutes as mosquito larvicides was examined, and four, thiodiphenylamine (phenothiazine), paradichlorobenzene, trichlorethylene and tetrahydronaphthalene (tetralin) were chosen for further comparison with a pyrethrum extract (Pyrotoxin 15). These five materials were used at concentrations of 0·15, 10, 10, 10 and 0·5 per cent., respectively, in a mixture of equal parts of kerosene and Diesel oil, and the mixture was emulsified with half its volume of water containing soap flakes [*cf. R.A.E.*, B **23** 205]. Paradichlorobenzene, tetralin and trichlorethylene were also tested as supplements to Pyrotoxin 15, the concentrations of both components in this case being halved. In laboratory experiments in which measured volumes of emulsions diluted 1 : 10 with water were sprayed on water in small basins containing Culicine larvae, a mixture of paradichlorobenzene and Pyrotoxin 15, paradichlorobenzene alone, tetralin and Pyrotoxin 15, and Pyrotoxin 15 alone caused 99, 91, 84 and 82 per cent. mortality, respectively, in 24 hours. The other larvicides gave 60 per cent. mortality or less. The results of field tests in ponds were similar to those obtained in the laboratory, with a few exceptions. The mixture of paradichlorobenzene and Pyrotoxin 15 was the most effective, and was equally effective in emulsions one week or two

months old. Tetralin and Pyrotoxin 15 was also good, sometimes excelling paradichlorobenzene, but tetralin seemed to lose toxicity with age. The addition of tetralin to Pyrotoxin 15 increased the kill effected within one and four hours of treatment. The results obtained with trichlorethylene and phenothiazine were disappointing, though as the former is comparatively cheap, and only a small percentage of the latter was used, more satisfactory result might be obtained by using larger quantities. Phenothiazine may prove useful as a slow larvicide, as ponds treated with it showed a higher kill after 48 hours than those treated with tetralin and Pyrotoxin 15 or Pyrotoxin 15 alone, and they remained free from larvae for surprisingly long periods. A suitable solvent for it or a practical means of application has not been found. In emulsions made with larger quantities of phenothiazine in oil than those used in the experiments, undissolved powder collected on the sides of containers. Most larvicides were slower in action when the atmospheric humidity was high, but those containing paradichlorobenzene appeared to be at their best during humid weather. Tetralin was slightly toxic to mosquito-eating fish but had no ill-effects on ducks kept in ponds treated twice weekly for three weeks with twice the usual volume of larvicide. Paradichlorobenzene appeared toxic to neither fish nor ducks, but the trichlorethylene emulsion rapidly killed the fish and had a toxic effect on ducks.

Yao (Y. T.) & Wu (C. C.). **Notes on the Chinese Species of Genus *Phlebotomus*. Part IV. Diagnostic Tables for the Chinese Species of Sandflies with some Remarks on their geographical Distribution.** —*Chin. med. J.* **60** no. 1 pp. 73–78, 5 pls., 7 refs. Peiping, 1941. **Part V. Some additional Records of *Phlebotomus* from Yunnan Province, South China.**—*T. c.* pp. 79–80, 5 refs.

Keys are given in the first paper to both sexes of the species and varieties of *Phlebotomus* occurring in China, with notes on their distribution. They comprise *P. chinensis*, Newst., *P. sergenti* var. *mongolensis*, Sinton, *P. kiangsuensis*, Yao & Wu, *P. stantoni*, Newst., *P. iyengari* var. *hainanensis*, Yao & Wu, *P. barraudi*, Sinton, *P. barraudi* var. *kwangsiensis*, Yao & Wu, *P. bailyi* var. *campester*, Sinton, *P. kachekensis*, Yao & Wu, *P. pooi*, Yao & Wu, *P. squamirostris*, Newst., *P. khawi*, Raynal, and *P. squamipleuris*, Newst. The reference given in the bibliography for the original descriptions of *P. iyengari* var. *hainanensis* and *P. kachekensis* is *Trans. 10th Congr. Far East. Ass. trop. Med., Hanoi*, 1938 (in press) and that given for the descriptions of *P. barraudi* var. *kwangsiensis* and *P. pooi* is *Chin. med. J.* **59** p. 67, 1940. [Neither of these papers is available to this Institute.]

In the second paper, it is recorded that 208 sandflies were collected in Mangshih, Yunnan, in 1940, 203 of which were *Phlebotomus barraudi* [*cf. R.A.E.*, B **23** 129] and 5 *P. stantoni*, and three were taken in Kunming, all *P. chinensis*. The finding of *P. chinensis* in southern China is of interest because it is the most important transmitter of visceral leishmaniasis in the country [**25** 1 ; **28** 35].

Paper noticed by Title only.

Martini [E.]. **Aus der Epidemiologie der Schlafkrankheit und Nagana.** [A Survey of Data on the Epidemiology of Sleeping Sickness and Nagana.]—*Z. angew. Ent.* **28** pt. 2–3 pp. 488–500. Berlin, 1941.

HOBSON (R. P.). **Sheep Blow-fly Investigations. IX. On some physical Aspects of Sheep Dipping.**—*Ann. appl. Biol.* **28** no. 3 pp. 261–272, 6 graphs, 13 refs. London, 1941. **X. On the Possibilities of Calomel for the Control of Sheep Maggots.**—*T.c.* pp. 273–281, 1 graph, 4 refs.

Investigations in Wales on the effect of wetting agents on arsenical sheep dips for the control of blowflies are reported in the first of these posthumous papers. The experimental methods are described. The protective value of a dip, assessed by placing eggs of *Lucilia sericata*, Mg., on the skin under a plug of damp cotton-wool, was impaired by the presence of a wetting agent, which decreased the amount of arsenic retained in the fleece, but circumstances were such that loss of arsenic might have been due to leaching by rain. In laboratory experiments with pieces of fleece dipped in water and then in solutions of wetting agents, soap and proprietary agents markedly decreased the amount of water retained, and gelatine, casein and suint also decreased it, while sulphite lye increased it. As suint, the properties of which are briefly reviewed, is water-soluble and must accumulate in the dipping bath, experiments were carried out to determine whether the protective properties of the dip are affected by the passage of a large number of sheep through the bath. The last three of 264 sheep dipped in April 1939 were found to be more susceptible to artificial infestation than the first three, to have a much lower arsenic content in their fleece, though the dip had not become weaker, and to lose arsenic much more rapidly through the action of rain. The initial distribution of soluble arsenic along the staple was similar in all sheep immersed in fresh dip, the middle fraction containing the least. The distribution was later reversed, the arsenic content remaining constant in the middle and decreasing at the tip as a result of leaching and at the base as a result of the growth of new wool [*cf. R.A.E.*, B **29** 101]. When the dip had become contaminated with suint, the arsenic deposited in the fleece decreased from the base to the tip of the staple, and all fractions of the staple lost arsenic at the same rate in the first 25 days after dipping (which suggests that rain was penetrating further into the fleece), while in the next 25 days, loss was confined to the tip and the base. A possible explanation of this is discussed. In laboratory tests, immersion in water removed more soluble arsenic or zinc arsenite from wool that had been dipped in liquid containing suint than from wool dipped in the clean solution or arsenite suspension. The effect of suint was not corrected by the addition of adhesives. Sulphite lye produced similar results to suint, but Agral 2 had little effect.

The arsenic content of the wool after dipping was found to be lower on the sides of the body than on the back, and lower in lambs than in sheep having longer wool. There was no appreciable difference in the amount of arsenic retained in the fleece of lambs dipped for 15 and 30 seconds, respectively. The inner and outer halves of the fleece lost, respectively, 35 and 75 per cent. of their soluble arsenic during the first week after dipping, presumably owing to leaching. In the following two weeks there was practically no loss, though a considerable amount of rain fell. The apparent effect of leaching on the inner fraction of the fleece in lambs and not in sheep is presumably due to the fact that the wool of the latter is longer and much denser. The adaptation of the sheep's fleece for excluding rain and the bearing of this on its ability to be wetted by dipping fluids are discussed. The addition of a wetting agent decreases the protective properties of the dip, but facilitates mixing and thus prevents injury to the sheep by floating particles. The dip should be changed at fairly frequent intervals to correct the effect of excessive suint. The literature on the penetration of the fleece by rain and leaching of soluble arsenic is briefly reviewed.

The second paper records experiments on the use of calomel [mercurous chloride] as an ovicide against blowflies. This material, the active principle of

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which appears to be mercury vapour, was chosen because the toxic vapour is given off for several weeks. The experimental materials and methods are described. In preliminary tests, dipping in spring with 0·2 per cent. calomel made the wool of yearlings toxic to eggs for 6 weeks and dipping in summer with 0·1 per cent. made the wool of lambs lethal for 4 weeks. A more detailed study was therefore made. Calomel alone was not ovicidal, but it was made so by the addition of crude wool or various fractions of wool and other substances, which were either reducing compounds or compounds that neutralised acidity. Strongly alkaline materials caused the calomel to darken owing to the separation of mercurous oxide or mercury. Calomel appeared to be more effective at high than at low temperatures.

In small scale tests, there was very little difference between the ovicidal properties of the fleece of yearlings dipped in calomel at 0·4 and at 0·15 per cent. and these properties were, if anything, greater after 27 than 12 days. The addition of 0·15 per cent. dextrin to calomel at the same strength lowered toxicity, presumably because it decreased retention of the liquid. The wool of lambs dipped in 0·2 per cent. calomel remained ovicidal for 5 weeks in laboratory tests but for less than 4 weeks in the field. The ovicidal properties decreased as the amount of calomel in the dip was reduced from 0·2 to 0·1 and 0·05 per cent. Colloidal calomel was no more effective than the standard calomel, nor was ovicidal action improved by the addition of zinc arsenite, which had been shown to activate calomel, presumably because the sheep's wool does so. A calomel dip afforded some protection against the development of the maggots on lambs that had been artificially infested with eggs on the point of hatching. The calomel, which had been shown to be toxic to larvae that fed on it, may have acted as a stomach poison or had some effect on the sheep's skin. The vapour is not toxic to larvae. Carbolic dip at normal strength and 0·1 per cent. calomel killed eggs of *L. sericata* in sheep's wool but an arsenic-sulphur dip at five times normal strength did not, and it is possible that young maggots may survive if the dip has not dried. In practice, infestation by larvae sometimes occurs 3–4 days after dipping in arsenic, and it could probably be avoided if an ovicide were added to the dip. Calomel is unsuitable for this purpose as it is decomposed by alkaline solutions, and it is incompatible with carbolic dips since it breaks the emulsion. Extensive field experiments with dips of calomel in 1940 revealed little difference between its effectiveness and that of arsenic in preventing infestation, but it is less poisonous to animals and does not scald the sheep's skin. Its expensiveness, however, may limit its use in dips. It appears to be particularly suitable as an ingredient of dusts, as it acts over a distance. It was found best to apply a dust from a tin with holes punched in the lid. Calomel dust gave good results in 1939 at three farms where infestation was relatively low among the controls, but failed in this and the next year at a farm where infestation was high. As calomel can safely be applied to wounds, is mildly antiseptic and renders the wool ovicidal for a considerable time, it should be useful as a dressing to protect wounds from reinfestation.

ROBERTS (F. H. S.). **The Buffalo Fly** (*Lyperosia exigua* **de Meijere**).—*Qd agric. J.* **56** pt. 1 pp. 34–42, 6 figs. Brisbane, 1941.

Most of the information in this paper on *Lyperosia exigua*, de Meij., in Australia has been noticed from an earlier one [*R.A.E.*, B **19** 158] of which this is a somewhat extended revision. The fly entered Queensland from the Northern Territory in 1928, and its subsequent distribution in Queensland fluctuated considerably according to rainfall, but its progress eastward was impeded for years by a stretch of comparatively dry plain land, which it crossed in 1939. The presence of a large proportion of moisture in the cattle dung in which the eggs are laid is necessary for larval development, 68 per cent. being the optimum, and few individuals normally survive the dry winter months.

Large numbers persisted, however, in 1939 and 1940, on account of the heavy summer rains and mild, windless winters, in which the dung remained moist. In 1941, the distribution of the fly extended along the coast of the Gulf of Carpentaria from the border of the Northern Territory to the Mitchell River and thence inland for 100–300 miles. The flies dislike dust, and cattle worked under dusty conditions quickly lose their infestations. Cattle appear to be able to tolerate easily populations of 1,000 flies or less, while they suffer ill effects from the presence of 1,000–2,000, and more than 2,000 are definitely serious.

LEVER (R. J. A. W.). **Spread of *Megarhinus* Mosquito.**—*Agric. J. Fiji* **12** no. 2 p. 49, 3 refs. Suva, 1941.

Megarhinus splendens, Wied., which was introduced into Fiji from Java in 1931 and 1932 for the control of *Aëdes scutellaris*, Wlk. (*variegatus*, Dol.) var. *pseudoscutellaris*, Theo. [*R.A.E.*, B **22** 94], was recovered in April 1941 in Mago (Mango) Island, which is separated by 12 miles of open sea from the nearest point at which colonies were liberated.

BOYD (M. F.), KITCHEN (S. F.) & MATTHEWS (C. B.). **On the natural Transmission of Infection from Patients concurrently infected with two Strains of *Plasmodium vivax*.**—*Amer. J. trop. Med.* **21** no. 5 pp. 645–652, 2 figs., 3 refs. Baltimore, Md., 1941.

Accounts are given of experiments on the ability of Anophelines to transmit either or both of two strains of a species of *Plasmodium* (*P. vivax*) when fed on persons concurrently infected with both. It is concluded from the results obtained, which were in some respects difficult to interpret, that they may either become infected with one of the strains only or possibly become infected with both and propagate them simultaneously.

KOMP (W. H. W.). **The Occurrence of *Anopheles darlingi* Root in Central America.**—*Amer. J. trop. Med.* **21** no. 5 pp. 659–670, 1 map, 3 figs., 17 refs. Baltimore, Md., 1941.

The finding of *Anopheles darlingi*, Root, near Stann Creek, British Honduras, in November 1939 and March 1940, and the identification as *A. darlingi* of six females taken in Guatemala in 1932 [*R.A.E.*, B **28** 198] are recorded in this paper. Larvae and females of the same species were found in Spanish Honduras in November 1940, and it is suspected that adults caught in houses there in the winter of 1924–25 and identified as *A. argyritarsis*, R.-D., were in reality also *A. darlingi*, which was not described until 1926 ; *A. argyritarsis* is never found in houses or attacking man in the Panama Canal Zone, where it is one of the commonest jungle species.

Severe malaria is known to be present in British Honduras and Guatemala. In August 1940, H. W. Kumm caught adults of *A. darlingi* in houses in the Stann Creek Valley and the Toledo District of British Honduras, and one stomach infection was found in 32 dissections from the former locality and one gland infection in 24 dissections from the latter. Knowledge of *A. darlingi* in South America is reviewed from the literature with special reference to its high natural infection rates, and recommendations are made for further work in Central America.

KNIPE (F. W.). **The Use of solidified Carbon Dioxide in developing Pressure for Spray-killing adult Mosquitoes in Malaria Control.**—*Amer. J. trop. Med.* **21** no. 5 pp. 671–679, 6 figs., 3 refs. Baltimore, Md., 1941.

In the course of experiments to develop an efficient apparatus for spraying against adult Anophelines, which is being done with success for malaria control

in southern India [*R.A.E.*, B **28** 92 ; **29** 153], various types of equipment were tested for producing and maintaining the required volume of air to supply the pressure to atomise the spray. In this paper, details are given of the construction, adjustment and operation of equipment in which solidified carbon dioxide is used to generate gas pressure ; this was found to be the most satisfactory. It gave adequate pressure without auxiliary equipment, was easy and quick to use, required no adjustment after the initial setting and reduced risk of fire. In southern India, however, it has the great disadvantage that solidified carbon dioxide is very expensive.

Boyd (M. F.). **On the Temperature of Incubation for Anophelines infected with** *Plasmodium falciparum.*—*Amer. J. trop. Med.* **21** no. 5 pp. 689–694. Baltimore, Md., 1941.

For several years the author has incubated Anophelines infected with *Plasmodium falciparum* at the same temperature (20°C. [68°F.]) as those infected with *P. vivax*, but the results have been less satisfactory both as regards qualitative infection (percentage of mosquitos infected in a batch) and quantitative infection (number of oöcysts per infected stomach) [*cf. R.A.E.*, B **21** 73]. To ascertain whether results could be improved by incubation at a higher temperature without causing high mortality among the mosquitos, experiments were made with *Anopheles quadrimaculatus*, Say, at 28°C. [82·4°F.], as preliminary observations had shown that the mosquitos could withstand incubation at this temperature. Humidity was kept high. The quantitative incidence of infection with *P. falciparum* was significantly increased under these conditions, except in the lowest ranges of gametocyte density, but the qualitative incidence was not. There was no noticeable difference in mortality of mosquitos attributable to temperature.

Chin (Yin-ch'ang) & Anderson (H. H.). **Chloro-hexyl-meta-cresol, related Cresols and other Insecticides which have low Toxicity for Mammals.**—*Peking nat. Hist. Bull.* **16** pt. 1 pp. 45–53, 34 refs. Peiping, 1941.

With a view to finding an insecticide that would be effective in a spray against mosquitos and relatively non-toxic to man and domestic animals and that would not need to be dissolved in oil, which is too expensive for use in China, experiments, the technique and results of which are described, were carried out with a number of cresols and cresol derivatives, using *Drosophila melanogaster*, Mg., as the test insect. Chloro-hexyl-meta-cresol was by far the most toxic of the compounds tested. It caused 92·7 and 96·7 per cent. mortality at concentrations of 1 and 2·5 per cent. in 95 per cent. ethyl alchohol and 93 per cent. mortality at a concentration of 1 per cent. when emulsified with 1 per cent. soap in water, and was at least as effective as the pyrethrum spray used for comparison. Soap solution alone killed only 7·4 per cent. of the flies. The chloro-hexyl-meta-cresol showed very low toxicity to rats when administered as a stomach poison, and chlorination was found to decrease the toxicity of all the three isomeric hexyl-cresols for mammals. Further tests, details of which are not given, were carried out with many other substances, chiefly synthetic compounds, but none was so effective as chloro-hexyl-meta-cresol.

Hu (S. M. K.). **Studies on the Susceptibility of Shanghai Mosquitoes to experimental Infection with** *Microfilaria malayi* **Brug. V.** *Armigeres obturbans* **Walker.**—*Peking nat. Hist. Bull.* **16** pt. 1 pp. 55–65, 2 pls., 7 refs. Peiping, 1941. **VI.** *Aëdes albopictus* **Skuse.**—*T. c.* pp. 67–70, 1 pl., 2 refs.

These two papers contain records of experiments, similar to others already noticed [*R.A.E.*, B **29** 140 etc.], that were carried out during 1939 and 1940 in

Shanghai to test the susceptibility to infection with *Filaria* (*Microfilaria*) *malayi* of *Armigeres obturbans*, Wlk., and *Aëdes albopictus*, Skuse, respectively. Of 140 adults of *Armigeres obturbans* that had engorged on patients with light infections, only one, dissected 13 days after the feed, harboured an infective larva, 118 were negative and 21 contained dead immature larvae. Out of 25 adults of *Anopheles hyrcanus* var. *sinensis*, Wied., fed at the same time as some of the 140, 17 contained infective larvae on dissection [*cf.* **29** 93]. All the 149 adults of *Armigeres obturbans* fed on a patient with a heavy infection contained immature larvae at the time of dissection, and 11 contained infective larvae also, those in three of them being alive. Most of the immature larvae had died in the first stage and had undergone chitinous encapsulation. The greatest number of living infective larvae found in one mosquito was 6, and the greatest total number of larvae in one mosquito was 97. When a female of *A. obturbans* and one of *Anopheles hyrcanus* var. *sinensis* were fed at the same time on a heavily infected patient and dissected 28 and 20 days later, respectively, the former was found to be harbouring 2 encapsulated, dead, ensheathed microfilariae in its abdomen and 13 dead, encapsulated, first-stage larvae in its thorax, of which 11 were in the sausage form and 2 had started to elongate towards the first ecdysis, while the latter contained 38 infective larvae. Although the susceptibility of *Armigeres obturbans* to infection is thus shown to be low, it is possible that, as it is one of the most common household mosquitos in the lower Yangtze region, where it breeds in heavily polluted water, it may play a minor part in the transmission of infection [*cf.* also **27** 45]. It comprised 1,250 out of 11,740 mosquitos collected in a man-baited trap during 1934 in a village in the Kaochiao district, and 383 out of 1,216 taken in houses in the Woosing region in September and October 1933.

Of 180 individuals of *Aëdes albopictus* fed on lightly infected patients, two were found on dissection to contain single, dead, encapsulated immature larvae. The others were negative. Of 175 fed on a heavily infected patient, 77 were negative, while the remainder were harbouring dead first-stage larvae, most of which were encapsulated microfilarial forms in the abdomen.

Shah (M. H.). **Report on the Epidemic of Oriental Sore in Delhi.**—*Indian med. Gaz.* **76** no. 8 pp. 449–457, 2 pls., 11 refs. Calcutta, 1941.

An account is given of an outbreak of dermal leishmaniasis involving nearly 20,000 individuals that occurred in Delhi in 1939–40. The distribution of the disease in India extends over the whole of the western and drier portions of the Indo-Gangetic plain from North West Frontier Province and Baluchistan to Delhi. The methods used in the treatment of cases in the Delhi outbreak are discussed. Individuals of *Phlebotomus sergenti*, Parr., collected near a school from which the first cases were reported were found to be heavily infected with the flagellate forms of *Leishmania tropica*. This apparently confirms the suggestion that this sandfly is the vector of dermal leishmaniasis in India [*R.A.E.*, B **13** 122 ; **23** 258]. As infected dogs were found in the school and an outbreak of the disease in dogs preceded the epidemic in the boys, it is thought that dogs may be the reservoirs of the infection.

Roy (D. N.) & Roy (P. C.). **Observations on the Relationship between Malaria and *Pistia* in two Villages in Murshidabad District.**—*Indian med. Gaz.* **76** no. 9 pp. 538–542, 10 refs. Calcutta, 1941.

Epidemiological studies on the relation between malaria and *Pistia stratiotes* were carried out in two villages in the district of Murshidabad (Bengal) in 1939–40. In one of them, *Pistia* was removed from reservoirs, which were potential breeding places of Anophelines, and in its place other vegetation was introduced. In the other village, all vegetation except *Pistia* was removed. At the end of two malaria seasons, a progressive and marked decline of malaria had taken

place in the former village, and a corresponding increase had occurred in the latter. The manner in which this was brought about is not clear. The junior author suggested on the basis of earlier observations that mosquitos bred from larvae that had had the opportunity to feed on *Pistia* become susceptible to plasmodial infection (though it is not known whether the larvae actually feed on it) and that with the exception of *Anopheles subpictus*, Grassi, and *A. vagus*, Dön., all Anophelines breeding in association with *Pistia* are potentially dangerous. On the other hand, the senior author found no difference in the infectivity of two batches of *A. stephensi*, List., bred out with and without *Pistia*, respectively. It is possible that the local vector of malaria in Murshidabad district is *A. philippinensis*, Ludl., and this Anopheline has been shown to be associated with *Pistia* in other parts of India.

CHABELARD (R.). **A propos de la larve d'***Anopheles multicolor***.**—*Bull. Soc. Hist. nat. Afr. N.* **32** no. 1–4 pp. 21–24, 4 figs. Algiers, 1941.

In view of a divergence of opinion in the literature on the branching of the inner submedian prothoracic hairs of the larva of *Anopheles multicolor*, Camb., and the possibility that it might indicate a racial distinction between the individuals of this species from north Africa and those from elsewhere, 188 larvae from Algeria and Tunisia were examined. The hairs in question were found to vary from being completely simple to having 15 branches. The larvae were classified according to size and to the relation between the length of the head and the width of the chitinous collar, and were found to fall into two groups : those that were presumed not to have reached the fourth instar, in which the hairs were simple or had only one or two branches, and those that presumably had reached the fourth instar, which had sometimes four, usually five and occasionally many more branches. The fact that in the latter group the hairs had usually five branches and sometimes more showed that specimens from north Africa do not differ from those from India, Egypt or Persia. It is concluded that the characters of this hair, which many authors have used in keys, should not be employed as a means of distinguishing the larvae of *A. multicolor* from those of *A. hispaniola*, Theo. It would be preferable to use those of the mesothoracic pleural bristles, which are constant even in young larvae.

DAVEY (T. H.). **The Larva and Pupa of** *Anopheles brunnipes* **Theobald.**—*Ann. trop. Med. Parasit.* **35** no. 1 pp. 5–8, 9 figs. Liverpool, 1941.

In the course of a mosquito survey of the Protectorate of Sierra Leone [*cf. R.A.E.*, B **29** 36], adults of *Anopheles brunnipes*, Theo., were taken in houses in two localities during the early part of the dry season, and larvae from which adults of the same species were bred were found in four breeding places in three widely separated districts. The water in all the breeding places was flowing slowly, and was completely exposed to sunlight or partly shaded for some of the day. All the streams had mud bottoms and contained surface vegetation. The larva and pupa are described. None of some 60 females caught in houses could be induced to oviposit.

SEATON (D. R.) & LUMSDEN (W. H. R.). **Observations on the Effects of Age, Fertilization and Light on Biting by** *Aëdes aegypti* **(L.) in a controlled Microclimate.**—*Ann. trop. Med. Parasit.* **35** no. 1 pp. 23–36, 3 figs., 1 graph, 19 refs. Liverpool, 1941.

The following is substantially the authors' summary. An apparatus is described in which previously starved females of *Aëdes aegypti*, L., were offered blood-meals at a controlled temperature of 24·5–25·5°C. [76·1–77·9°F.] and

4·5–5·5 mm. Hg saturation deficiency. When virgin mosquitos of six consecutive age-groups from 0–24 to 120–144 hours old were offered blood-meals in darkness, the largest numbers fed in the groups 72–96 and 96–120 hours old. The percentages fertilised in three groups of virgin females allowed access to males on the first, second and third nights after emergence, respectively, were 12, 50 and 82. No difference was detected in the desire for a blood-meal of virgin and fertilised mosquitos aged from 72 to 96 hours. Virgin mosquitos aged 72–96 hours were divided into two groups, one being offered a blood-meal in darkness, the other with a direct illumination of 0·5 metre candles at the area to be bitten. The effect of the light was to reduce the number biting by almost half. The mean length of life of starved mosquitos at 23·5–25·5°C. [72·3–77·9°F.] and 78·5–87 per cent. relative humidity was 4·8 days, and all were dead after 7 days.

Blacklock (D. B.) & Wilson (C.). **Notes on** *Anopheles gambiae* **and** *A. gambiae* **var.** *melas* **in Freetown and its Vicinity.**—*Ann. trop. Med. Parasit.* **35** no. 1 pp. 37–42, 2 refs. Liverpool, 1941.

After his expedition to Freetown, Sierra Leone, in 1899, Ross concluded that the bulk of the Anophelines that visit a house at night do not remain there in the daytime. Between September 1940 and the end of March 1941, outhouses in Freetown, and in December the neighbouring hedges also, were searched for mosquitos, but those found included no Anophelines. On 10th March, larvae and pupae of *Anopheles gambiae*, Giles, were found in considerable numbers in a seepage-fed rock-pool area in the town. There were no individuals of *A. gambiae* var. *melas*, Theo., among the adults reared. On 15th March, the premises of the Coaling Company, which were not far from this area, were searched without any mosquitoes being found on hedges or shrubs or on or under the houses. On 22nd, however, 14 individuals of *A. gambiae* were taken, some of them on the hedges, and on 23rd, when the hedges and shrubs alone were examined, 21 females of *A. gambiae*, all recently fully fed, were taken. As the original breeding place had been treated almost as soon as it was discovered, it was almost certain that another and nearer breeding-place had begun to produce adults. This was found next day. It was a freshly made cutting for a lighter slipway, the soil of which was soft laterite material ; the floor, which was of a dark orange colour, was glistening owing to a thin film of seepage-water and was pitted with footprints, Larvae were abundant in the water in the footprints and in the thin film of seepage water. The cutting was absolutely free from vegetation and exposed to the sun. Several hundred larvae and many pupae were immediately collected, and the slipway was then oiled and drained so that breeding stopped. The larvae were dark orange to light red in colour, doubtless on account of the colour of the soil, and they and the pupae and adults bred from them were very small, probably because of the insufficiency of the food-supply. The occurrence of the larvae in such large numbers may be attributed to the absence of natural enemies or to the lack of suitable, untreated water for oviposition in Freetown at the dry season, which would lead the females to crowd to a new supply. Two adults were found inside a house on 25th March ; after this date no more were found.

In a batch of 55 males and 14 females bred in the laboratory from the slipway site, 5 of the females were *A. gambiae* var. *melas*. It is thought that this brackish-water variety [*cf. R.A.E.*, B **20** 64] is likely to be of great importance in the whole harbour area of Freetown. Six out of 69 females of *A. gambiae* bred in March and April 1941 from the lower end of Nicol's Brook, the more easterly of two large streams that run through Freetown, belonged to it. Between 25th November 1940 and 18th April 1941, it was found in six out of seven villages on the Bullom shore in which houses were examined for adult Anophelines. Of the 487 individuals of *A. gambiae* taken, 133 were females of

var. *melas*. All the males caught were included with *A. gambiae* as no reliable method of distinguishing the forms was available. Of 30 females of var. *melas* dissected, two contained microfilariae, one malaria sporozoites and one both. The Bullom area is flat, with creeks running for long distances inland. In most cases, a sluggish stream of fresh water enters the creek from a marshy area, and a village is on a slight eminence close by. Control of var. *melas* might be obtained by draining the marsh into the creek, but irrigation for cultivated land would then have to be provided.

FINDLAY (G. M.). **Yellow Fever and the Anglo-Egyptian Sudan : Historical.**—*Ann. trop. Med. Parasit.* **35** no. 1 pp. 59–65, 16 refs. Liverpool, 1941.

KIRK (R.). **An Epidemic of Yellow Fever in the Nuba Mountains, Anglo-Egyptian Sudan.**—*T. c.* pp. 67–112, 2 pls., 2 maps, 9 graphs, 30 refs. Liverpool, 1941.

From data given in the first paper, it is concluded that although there is no definite record of an epidemic of yellow fever in the Anglo-Egyptian Sudan prior to 1940, natives of Kordofan were immune from the disease when taken to Mexico in 1863. There is also evidence that they were far more resistant than Egyptians to fevers present in the Upper Nile Province of the Anglo-Egyptian Sudan. There is no evidence to suggest that yellow fever has been recently introduced into the Sudan.

In the second paper, a detailed account is given of the course and clinical features of the epidemic of yellow fever that occurred in the Nuba Mountains District of the southern Sudan in October 1940 [*R.A.E.*, B **29** 115]. In addition to typical cases, there were many in which the infection produced only a mild fever lasting about three days, and it is believed that the number of infections that occurred was very much greater than the number of recorded cases. The epidemic resulted in a much larger increase in the proportion of the population immune from yellow fever as shown by mouse-protection tests than could be accounted for by the recorded cases. In addition to *Aëdes aegypti*, L., other species of mosquitos known to be able to transmit the infection in the laboratory were found in the affected area. These included *A. vittatus*, Big. [*cf.* **17** 213], which was taken in October but not later. Adults of this species usually disappear completely when the rock-pools dry up in the dry season. This may be significant in view of the fact that the epidemic spontaneously ceased with the drying up of the rock-pools.

LEVAN (J. H.). **Present-day Methods for controlling *Aëdes aegypti* Mosquitoes.**—*Publ. Hlth Rep.* **56** no. 38 pp. 1875–1880, 2 pls., 4 refs. Washington, D.C., 1941.

Since *Aëdes aegypti*, L., breeds only in artificial containers, it is controlled by making frequent and careful inspections of all such containers, destroying the non-essential ones and treating those that are indispensable. In this paper, the methods at present used to accomplish this in the United States are explained. It is recommended that house-to-house inspections should be made about every 7 days in summer, but the interval may be increased to 14 days as the *aegypti* index approaches zero. Indispensable containers should be oiled every 10 days, screened and reconstructed to make them mosquito-proof, or stocked with *Gambusia* [*R.A.E.*, B **29** 60, 193]. In cases of severe infestations of adults, houses may be sprayed with pyrethrum in oil. Piles of old motor tyres, if they cannot be kept dry, should be dusted with a mixture of Paris green and lime.

DAVIS (G. E.). *Ornithodoros hermsi* **and Relapsing Fever in Oregon.**—*Publ. Hlth Rep.* **56** no. 41 pp. 2010–2012, 8 refs. Washington, D.C., 1941.

The first two proved cases of relapsing fever in Oregon occurred in the summer of 1940 in the central part of the State, and three suspected cases have been reported from the same locality, which is remote from any previously known focus. In early October, 52 individuals of *Ornithodoros hermsi*, Wheeler, were found in a hollow pine log in the immediate neighbourhood, and were allowed to feed in groups of 4–7 on 10 white mice, from 6 of which spirochaetes were recovered. Three of the strains were particularly invasive, while the course of infection in the other three mice was milder.

O. hermsi is a proved vector of relapsing fever in California, Colorado and Idaho [*R.A.E.*, B **29** 145] and undoubtedly transmits it in Nevada, a tick of this species having been collected from a summer dwelling in which practically the whole family had contracted the fever some years previously. It has been collected only in timbered regions and mostly at relatively high altitudes. In California and Idaho, it has been reported chiefly from summer cabins, and in Colorado only from Douglas-fir snags. Usually only a few individuals are collected at one time, but the numbers taken in seven snags in Colorado varied from 21 to 318. The new endemic area in Oregon is heavily timbered. The trees in the area where *O. hermsi* was found had been cut, leaving numerous stumps, snags and logs. It is thought that one means of acquiring relapsing fever here may be direct or indirect contact with wood. Neither of the two proved cases had any known contact with rodents, but one of them often stood up to the hips in shavings of shredded pine in the course of his work. The only species of *Ornithodoros* other than *O. hermsi* that has been collected in Oregon is *O. parkeri*, Cooley [*cf.* next abstract], which has never been taken in timbered regions. It therefore appears reasonably certain that the local vector of relapsing fever is *O. hermsi*.

DAVIS (G. E.). *Ornithodoros parkeri* **Cooley : Observations on the Biology of this Tick.**—*J. Parasit.* **27** no. 5 pp. 425–433, 8 refs. Lancaster, Pa., 1941.

The counties in the United States in which *Ornithodoros parkeri*, Cooley, occurs and its natural and experimental hosts [*R.A.E.*, B **28** 28, 137] are recorded and data on its biology and relation to disease are reviewed. It has been found in Nevada, California and Oregon, in addition to States already noticed [**28** 28]. Larvae, nymphs and adults of both sexes may engorge in 15–30 minutes. When engorgement is nearly complete, there is a copious discharge of coxal fluid, but this fluid has not been shown to play any part in transmitting relapsing fever or Rocky Mountain spotted fever. When injected into white rats and guineapigs, fluid from infective ticks did not cause infection, and a host may become infected with relapsing fever within a minute of the attachment of the tick and before coxal fluid has appeared. At room temperature, the larval stage and five nymphal instars lasted 7–28, 7–41, 10–74, 13–49, 16–59 and 25 days, respectively. Of 198 ticks reared to the adult stage, 18 males required two nymphal instars, 45 males and 37 females required three, 46 males and 51 females four, and one female five. Late nymphs, and adults of both sexes, can survive at least four years of fasting. Oviposition before pairing has not been observed. The dates of engorgement and copulation, appearance of the first eggs and of the first larvae and the total number of eggs and larvae produced are given for 11 females. The shortest interval between engorgement and oviposition was 17 days, and the longest 120. In Wyoming and Montana stock, there was a marked tendency to a rest period in oviposition through the winter and early spring months. The largest number of eggs deposited at one oviposition was 377 and the average 222. On two occasions,

one tick was observed to puncture another and engorge, but in both instances the tick host was able to perform normally the functions of moulting, pairing and oviposition.

O. parkeri has not been definitely connected with relapsing fever in man, but it feeds readily on man and is the only species of the genus known in areas in which at least 17 cases have originated [**29** 145], and 12 individuals were collected from an endemic area in western Nevada. Spirochaetes have been recovered from ticks collected in five States including Nevada and California. It has not been found infected with Rocky Mountain spotted fever in nature, but nymphs and adults of both sexes experimentally transmit the disease from infected to healthy guineapigs. Two females have been shown to be infective 685 and 739 days, respectively, after an infective feed in the second nymphal instar, and transmission from generation to generation has been demonstrated. *Rickettsia diaporica*, the causal organism of American Q fever, survives and retains its virulence for many months in the tissues of successive stages of *O. parkeri*, but is not transmitted during feeding. The excrement of the tick is infective. *Bacterium tularense*, the causal organism of tularaemia, survives and retains its virulence in it for at least 701 days, but is not transmitted by feeding [**28** 197].

CHANDLER (A. C.). **A Case of Urinary Myiasis.**—*J. Parasit.* **27** no. 5 p. 465. Lancaster, Pa., 1941.

Three out of thirteen maggots that had been voided in the urine by a woman in Texas were submitted for examination and found to be third-instar larvae of a species of *Lucilia*, apparently *L. sericata*, Mg., or a closely related species. No information was offered that would indicate the source of the infestation.

TRAVIS (B. V.). **Examinations of Wild Animals for the Cattle Tick** *Boophilus annulatus microplus* **(Can.) in Florida.**—*J. Parasit.* **27** no. 5 pp. 465–467. Lancaster, Pa., 1941.

Examination of birds and mammals collected between November 1936 and February 1937 in areas of Florida where *Boophilus annulatus*, Say, or its southern variety *microplus*, Can., was known still to occur, together with a few records made in June 1933 by O. C. van Hyning, supported the conclusion that wild animals other than deer do not serve as hosts for these ticks. Ticks of eight other species were found on 4 species of birds and 12 mammals, and these hosts are named in a table, which shows the species of ticks found on each. A list is also given of 4 mammals and 17 birds on which no ticks were found, with the numbers of each examined. Of 22 deer, 4 that were killed in a large cypress swamp were infested with 3–182 individuals of *B. a. microplus*. The 18 uninfested ones were taken from woods in which cattle were allowed to roam and were dipped at regular intervals. It is not possible to control ticks by such a dipping programme in the swampy areas because the cattle do not move about freely in the dense swamps frequented by deer.

TATE (H. D.). **The Biology of the Tropical Cattle Tick and other Species of Tick in Puerto Rico, with Notes on the Effects on Ticks of arsenical Dips.**—*J. Agric. Univ. P. Rico* **25** no. 1 pp. 1–24, 3 refs. Río Piedras, P.R., 1941.

The following is based on the author's summary. *Boophilus annulatus microplus*, Can., has seriously hindered the development of the cattle industry in Porto Rico, both on account of the direct injury it causes to the animals through irritation and its debilitating effect and also because it transmits tick fever [*Piroplasma bigeminum*]. It formerly occurred in parts of the southern United States [*R.A.E.*, B **22** 129], but has now been practically eradicated,

and the area infested by the typical *B. annulatus*, Say, has also been greatly reduced [**29** 119]. This, together with the fact that both varieties are one-host ticks and seldom attack wild animals, indicated the feasibility of eradicating *B. a. microplus* from Porto Rico; its biology under local conditions was accordingly studied as a basis for control operations. Ticks in their non-parasitic periods were studied in bottomless glass tubes set in the soil, and those in their parasitic periods on cattle in isolated stalls. The preoviposition, oviposition and minimum incubation periods under different climatic conditions ranged from 2 to 6, 11 to 18 and 18 to 76 days, respectively [*cf.* **29** 111]. There was no marked seasonal variation in the length of life of larvae that failed to find hosts. It varied from 65 days in the dry southern coastal regions to 184 in the higher and wetter interior. The total period from the dropping of the engorged female to the death of the last larva ranged from 89 to 251 days. The larvae began to moult 8–12 days after their application to a host. Nymphs completed engorgement 12 to 26 days after attachment or 5 to 17 days after the larval moult, and engorged females dropped 5 to 23 days after the nymphal moult. The minimum period from attachment of the larva to the dropping of the engorged female was 18 days and the maximum 37 [*cf.* **25** 175; **29** 111]. The entire life-cycle may be completed within about 41 days or extend over some 300 days. The minimum parasitic period on goats, sheep and dogs was practically the same as that on cattle. The tick was found in considerable numbers on goats, sheep and horses, and these animals must be taken into account in an eradication campaign, but other mammals are apparently of little or no importance.

The only other ticks known to be established in Porto Rico are *Rhipicephalus sanguineus*, Latr., which is practically confined to dogs, and *Otocentor* (*Dermacentor*) *nitens*, Neum., which occurs chiefly on horses and also on sheep and goats but was not found by the author on cattle [*cf.* **29** 14]. No parasites were obtained from nymphs of *Boophilus* or *Otocentor*, but 40·4 per cent. of the nymphs of *Rhipicephalus* were parasitised by *Hunterellus hookeri*, How. Standard arsenical dips, such as are used in the continental United States diluted to a strength of 0·18–0·19 per cent. arsenious oxide, proved effective in destroying *B. a. microplus*, practically all the animals being free of engorged females after the second or third dipping. The same dip was effective against *O. nitens*, but considerably greater care is necessary in dipping horses than cattle to ensure that the solution comes in contact with all the ticks on the animal.

Studies on some Ectoparasites of Sheep and their Control.

Graham (N. P. H.) & Taylor (K. L.). **1. Observations on the Bionomics of the Sheep Ked** (*Melophagus ovinus*).—*Pamphl. Coun. sci. industr. Res. Aust.* no. 108 pp. 3, 7, 9–26, 12 refs., multigraph. Melbourne, 1941.

Freney (M. R.), Lipson (M.) & Graham (N. P. H.). **2. Chemical and biological Studies on certain arsenical Dipping Fluids.**—*T. c.* pp. 3–4, 7–8, 27–38, 2 figs., 25 refs.

Lipson (M.). **3. Chemical Observations on Commercial Powder Sheep Dips with special Reference to their Arsenic Content.**—*T.c.* pp. 4, 8, 39–44.

In the first paper, details are given of a study of the bionomics of *Melophagus ovinus*, L., on sheep in Australia [*R.A.E.*, B **29** 52; **30** 31–32], undertaken with a view to elaborating a more efficient dipping routine.

The second paper consists of an account of observations on arsenical dipping fluids designed to ascertain the time of immersion of sheep in normal dipping practice, which was found to be under 30 seconds, the amount of fluid removed from the dip by the sheep, the amount draining off them after certain intervals, the composition of the draining fluids and the effect of passing sheep through arsenical dipping fluids on the composition of the dips [**30** 32] and the efficiency

of dipping fluids containing arsenic compounds in freeing sheep from *M. ovinus* and *Bovicola ovis*, L. The sheep were dipped in solutions containing arsenic acid, sodium arsenate, arsenious acid, sodium arsenite or glycero-arsenious acid, and a suspension of arsenic trisulphide. All the dips were adjusted to contain 0·2 per cent. arsenic (As). The pentavalent arsenic compounds used eliminated the lice for the period that the sheep were kept under observation, but did not give complete kill of *M. ovinus*. The soluble trivalent arsenicals killed all adults of both, but whether all stages were eliminated was not established. The suspension of arsenic trisulphide showed only slight toxicity immediately after dipping and little residual toxicity.

The following is based on the author's summary of the third paper. Five proprietary dipping powders were analysed and found to consist mainly of free sulphur, the average amount of this constituent in the samples being 61·4 per cent. The arsenic occurred mainly as sodium arsenite, but sodium arsenate was also present. The percentage of soluble trivalent arsenic in four of the powders was very similar and averaged 8·42, but in the fifth, it was 13·0. Insoluble derivatives of arsenic and sulphur constituted, on an average, only 7·0 per cent. of the powder. Small amounts of organic material such as derris were also present. The results of analyses of samples collected before and after dipping sheep with one of these proprietary products showed that there is little drop in the arsenic content of the dip as the sheep pass through, but that the relative amount of soluble arsenic increases. Finally, the necessity for analysing dipping fluids as soon as they are collected is demonstrated by these experiments. Although the total arsenic content does not alter on storage, substantial changes can occur in the relative amounts of the soluble and insoluble forms.

Nash (T. A. M.). **Bats as a Source of Food for** *Glossina morsitans* **and** *G. tachinoides*.—*Bull. ent. Res.* **32** pt. 3 p. 249. London, 1941.

Sleeping individuals of the bat, *Nycteris hispida*, which occurs in large numbers in the residual forest islands at Gadau, Northern Nigeria, were readily attacked by *Glossina morsitans*, Westw., and *G. tachinoides*, Westw., when placed in a large cage with them. The flies had no difficulty in becoming fully engorged. It is possible that bats form a very important source of food for them when floods force the game to leave the river-plain, particularly for *G. tachinoides*, which is the less inclined to leave the forest islands [*R.A.E.*, B **25** 161] and is always the better-fed.

David (W. A. L.) & Havrey (G. L.). **Flies for the Peet-Grady Test.**—*Soap* **17** no. 10 pp. 103, 105, 2 figs. New York, N.Y., 1941.

A description is given of an apparatus designed to separate pupae of *Musca domestica*, L., from the medium in which they were reared without preliminary drying and without scattering the medium, and thus eliminate the two principal disadvantages of the method at present in use. The apparatus consists of a wind tunnel with converging walls ending in a wire gauze screen. The medium containing the pupae is conveyed by an endless belt operated by hand on to the gauze whilst a current of air is blown through it by an electric fan. As the mixture passes over the gauze, the light culture medium is blown away and collected in an adjoining box, while the pupae roll down the wire and are collected separately.

Whitmire (H. E.). **Stock Spray Base Oils. A Study of the Correlation between Repellency and natural Evaporation of common Livestock Spray Base Oils.**—*Soap* **17** no. 10 pp. 107, 109. New York, N.Y., 1941.

On the assumption that the rate at which sprays applied to cattle against flies lose their toxicity and repellency is proportionate to the rate of evaporation

of the base oil, experiments were carried out to determine the exact length of time that certain base oils would remain on an animal both indoors and outdoors when properly applied. The procedure, in which the oils were sprayed on to squares of hide tanned with the hair on, is described, and the results of observations in the form of successive half-hourly weighings are shown in tables for four oils, the analyses of which are given. These particular tests were made on a typical summer day, and each was terminated at the end of two hours, as by this time complete evaporation had taken place out-of-doors. During the study, the importance of the work on droplet size [*R.A.E.*, B **29** 125] with regard to the speed of evaporation of base oils was realised. It is believed that repelling efficiency should be carefully studied in relation to the rates of evaporation.

SABIN (A. B.) & WARD (R.). **Flies as Carriers of Poliomyelitis Virus in Urban Epidemics.**—*Science* **94** no. 2451 pp. 590–591, 3 refs. New York, N.Y., 1941.

In view of the recent accumulation of data suggesting that poliomyelitis [infantile paralysis] is primarily an infection of the alimentary tract, with secondary localisation in the central nervous system, and the consequent possibility that flies play a part in its transmission, several groups of investigators undertook a search for the virus in flies taken during outbreaks of the disease in the United States in the summer of 1941. Positive results with flies from two rural areas have recently been reported [*R.A.E.*, B **29** 195], and the demonstration of the virus is here recorded in three batches taken in urban areas during poliomyelitis outbreaks in July and August, two in widely separated sites in Cleveland and one in Atlanta. In each case, the flies were trapped close to houses in which cases of the disease had recently occurred. The fact that they were taken where there was no apparent opportunity for immediate contamination with faeces suggests that flies may play an important part in the transmission of the virus and may perhaps be responsible for the special seasonal incidence of the disease.

It is stated in foot-notes that the authors subsequently demonstrated the presence of the virus in flies caught in two additional parts of Cleveland, and that J. A. Toomey detected it in two specimens of flies taken in neighbouring rural areas, one near an open privy and the other near a creek containing sewage.

MUSGRAVE (A.). **Harmful Moth Caterpillars.**—*Aust. Mus. Mag.* **7** no. 11 pp. 391–396, 2 figs. Sydney, 1941.

Descriptions are given of the larvae, larval hairs, pupa and adult of *Euproctis edwardsi*, Newm., a Lymantriid that breeds chiefly on mistletoe (*Loranthus*) and has recently attracted attention in various localities near Sydney owing to the trouble caused by the urticating hairs of the larvae. A note is included in which G. A. Waterhouse expresses the opinion that the irritation is not caused by the hairs from the living larvae, but by those from the dried cast-off skins.

The author found the introduced bacon beetle, *Dermestes ater*, DeG. (*cadaverinus*, F.), attacking the pupae of this moth and also bred two adults of the Ichneumonid, *Echthromorpha intricatoria*, F., from the pupae.

PEREIRA BARRETTO (M.). **Sobre a astenobiose do "*Phlebotomus whitmani*" Antunes e Coutinho, 1939 (Diptera, Psychodidae).** [On the Asthenobiosis of *P. whitmani*.]—*Rev. brasil. Biol.* **1** no. 3 pp. 305–310, 6 refs. Rio de Janeiro, 1941.

In a previous study of *Phlebotomus whitmani*, Antunes & Coutinho, reared from females captured in nature in Brazil, the author found that this species

is heterodynamic, some individuals developing rapidly and regularly from egg to adult, while others of the same generation undergo a more or less prolonged diapause as fourth-instar larvae and then resume activity and transform into pupae that develop normally. The occurrence of heterodynamic individuals was acyclic, as in *P. papatasii*, Scop., and the diapause was independent of the external temperature and humidity.

In the present paper are recorded observations on the occurrence of the diapause in the offspring of females that had developed in the laboratory with or without a diapause. The cultures were not all kept at the same temperature, but there was no exposure to cold, the extremes being 18 and 28°C. [64·4 and 82·4°F.]. The percentages of larvae that diapaused ranged from 0 to 41·66 in the progeny of females that had diapaused, and from 8·33 to 47·59 in the progeny of those that had not. The diapause lasted from 83 to 176 days. Roubaud considered that the occurrence of a diapause in *P. papatasii* was due to a toxic action on the eggs [*cf. R.A.E.*, B **16** 183, 239] and that exposure to cold was necessary to break it [*cf.* **16** 56, 171], but in the author's experiments the diapause was terminated without alteration of temperature, and the larvae that hatched from eggs deposited the same length of time after a blood meal did not all diapause.

Ayroza Galvão (A. L.) & Coutinho (J. O.). **Nota sôbre um flagelado parasita de Anofelinos do sub-gênero "*Nyssorhynchus*," "*Herpetomonas pessoai*" n. sp. (Mastigophora, Trypanosomidae).** [*H. pessoai*, sp. n., a Flagellate parasitising Anophelines of the Subgenus *Nyssorhynchus*.]—*Rev. brasil. Biol.* **1** no. 3 pp. 311–319, 5 figs., 23 refs. Rio de Janeiro, 1941. (With a Summary in English.)

Herpetomonas pessoai, sp. n., is described from trypanosome, crithidial, leptomonad and leishmanial forms found in the digestive tract of 1 out of 28 females of *Anopheles triannulatus*, Neiva & Pinto (*davisi*, Paterson & Shann.) and 5 out of 63 of an Anopheline that is probably *A. oswaldoi*, Peryassú. These Anophelines were taken in a locality in the State of São Paulo, Brazil, in which mucocutaneous leishmaniasis is endemic. The second species could not be identified with certainty because none of the infected females oviposited and their ovaries were undeveloped. Many unparasitised females taken at the same time laid eggs of the *oswaldoi* type. The lack of development of the ovaries and the friability of the stomachs of the infected mosquitos were apparently the results of the pathogenic action of *H. pessoai*, which occurred exclusively in the stomach and hind gut.

Watson (R. B.) & Rice (M. E.). **Further Observations on Mosquito-proofing for Malaria Control.**—*Amer. J. Hyg.* **34** (C) no. 3 pp. 150–159, 3 graphs, 4 refs. Lancaster, Pa., 1941.

The investigations on the value of the mosquito-proofing of houses for malaria control that were begun in 1938 in the Tennessee Valley in northern Alabama [*R.A.E.*, B **30** 73] were continued in 1939 on a much larger scale in three areas within a mile of the lake where *Anopheles quadrimaculatus*, Say, was breeding in large numbers. The mosquito-proofing of all previously protected houses in the area under consideration in 1938 was repaired, and the remaining houses in this area were proofed before 1st June 1939, so that there were 207 protected houses under observation. In the second area, 131 houses were mosquito-proofed in June and July, and 173 houses in the third area were used as the control. Measures against Anopheline larvae were not carried out at all during 1939 in the first area and were discontinued in the second when the houses had been proofed. Mosquito collections indicated that production in the three areas was comparable.

The methods of collecting and analysing the data conformed with those used in 1938. Comparison of malaria indices in April, August and October among families in the first area revealed no significant difference between those living in houses protected in 1938 and 1939 and those in houses protected only in 1939, although parasites were slightly more prevalent in the latter than in the former in the August and October surveys. It appears, therefore, that the protection offered by mosquito-proofing becomes fully operative during the first season of malaria transmission in which it is used. Malaria prevalence in this area was small in 1938, however, and that in 1939 may represent an irreducible minimum. The percentages of positive blood films found in the three areas in April, August and October were 1·39, 2·17 and 2·38 in the first (these differences not being significant), 7·39, 6·27 and 2·25 in the second, and 5·36, 8·73 and 17·95 in the third. The significance of the relatively high October index for the control area was supported strongly by indices for adjacent communities. The fall in the index between April and August in the area in the course of being protected was not significant. This is not surprising as the season of maximum transmission of *Plasmodium vivax* had passed before the mosquito-proofing was half complete. The figures and total morbidity rates indicate, however, that a community progressively protected by a mosquito-proofing programme initiated after the season of malaria transmission has begun may obtain considerable protection in that season.

LAIRD (R. L.). **Observations on Mosquito Transmission of** *Plasmodium lophurae*.—*Amer. J. Hyg.* **34** (C) no. 3 pp. 163–167, 6 refs. Lancaster, Pa., 1941.

Examination of mosquitos that had fed on ducks infected with *Plasmodium lophurae* [*cf. R.A.E.*, B **26** 188; **29** 194; **30** 22] showed sporozoites in the glands of 2 out of 4 females of *Culex restuans*, Theo., all of 12 of *Aëdes atropalpus*, Coq., and 103 out of 108 of *A. albopictus*, Skuse, whereas no gland or stomach infection was found in 18 of *A. aegypti*, L., or 25 of *C. pipiens*, L. Transmission experiments were carried out with one heavily infected lot of *A. atropalpus* and five lots of *A. albopictus*. The former failed to transmit infection, as did three lots of the latter, but a duck on which the fourth lot had fed, the four ducks on which mosquitos of the fifth lot fed and the three into which macerated thoraces of the same lot were injected became infected.

HOPKINS (G. H. E.). **The Range of Flight of Anopheline Mosquitoes.**—*E. Afr. med. J.* **18** no. 6 pp. 175–183, 7 refs. Nairobi, 1941.

Only a few observations have been made on the range of flight of Anophelines in Africa [*cf. R.A.E.*, B **22** 55; **26** 120; **28** 48, 166], and anti-malaria work has been carried out on the assumption that it is sufficient to apply measures within one mile or in some cases half a mile of the point to be protected. An account is here given of the finding of *Anopheles funestus*, Giles, in numbers at a college on the summit of Mwiri, a hill in Uganda two miles to the north of Lake Victoria, which was the nearest breeding place, and from which the prevailing wind blew by day. Breeding was taking place over an extensive area of swamp at the edge of the lake. The data in the literature and the difference between maximum range of flight and maximum effective range are discussed, and it is concluded that although *A. funestus* produced a disquieting amount of malaria at the college, neither this species nor *A. gambiae*, Giles, is likely in normal circumstances in Uganda to fly much more than half a mile in sufficient numbers to be of importance, and that no change in the accepted practice is necessary, as it is better to effect thorough control over a small area than to dissipate energies by attempting partial control over a large one. The few mosquitoes that do fly so far are better dealt with by such measures as mosquito-proofing of houses and the use of bed-nets and mosquito-boots. When, however,

as at Mwiri, breeding is exceptionally extensive, the effective range may be two miles, or even more in the direction of the prevailing evening breeze. It is shown to be probable that most females entering buildings to feed do so in the evening. The evidence strongly suggests that the effective range is greatly reduced if the breeze is unfavourable.

Davis (G. E.). *Ornithodoros turicata* **and Relapsing Fever Spirochetes in New Mexico.**—*Publ. Hlth Rep.* **56** no. 47 pp. 2258–2261, 1 fig., 1 ref. Washington, D.C., 1941.

The following is almost entirely the author's summary. In a rapid tick survey of ten counties in southern and south-eastern New Mexico in August 1940, 41 lots with a total of 604 individuals, all *Ornithodoros turicata*, Dugès, were collected. One entire lot died in transit to the laboratory ; 539 ticks remained for testing, and eight lots representing four counties were found to harbour relapsing-fever spirochaetes. Only one proved case of relapsing-fever in man has been recorded in New Mexico ; it was contracted in a county in which four of the lots of infected ticks were found.

Papers noticed by Title only.

Liu (Wei-t'ung) & Zia (S. H.). **Studies on the Murine Origin of Typhus Epidemics in north China. II. Typhus Rickettsia isolated from Mice** [*Mus wagneri*] **and Mouse-fleas** [*Leptopsylla segnis*, Schönh.] **during an Epidemic in a Household and from Body Lice** [*Pediculus humanus*, L.] **in the Garments of one of the Epidemic Cases.**—*Amer. J. trop. Med.* **21** no. 5 pp. 605–625, 2 figs., 1 graph, 44 refs. Baltimore, Md., 1941. [*Cf. R.A.E.*, B **29** 137.]

Russell (P. F.). **A Classification of Measures of Malaria Prophylaxis and Mosquito Control.**—*Amer. J. trop. Med.* **21** no. 5 pp. 681–687, 5 refs. Baltimore, Md., 1941.

Newman (A. C.). **Description of Home-made Hydraulic Dredge employed** [against *Anopheles quadrimaculatus*, Say] **in Malaria Control at Perry, Florida.**—*Publ. Hlth Rep.* **56** no. 44 p. 2127, 1 pl., 1 fldg. diagr. Washington, D.C., 1941.

Woodhill (A. R.) & Pasfield (G.). **An illustrated Key to some common Australian Culicine Mosquito Larvae, with Notes on the Morphology and Breeding Places.**—*Proc. Linn. Soc. N.S.W.* **66** pt. 3–4 pp. 201–214, 11 figs., 14 refs. Sydney, 1941.

McIvor (B. C.). **A new Species of** *Ornithodoros* **Tick** [*cooleyi*, sp. n.] **from Nevada (Acarina : Ixodoidea).**—*J. Parasit.* **27** no. 5 pp. 435–436, 5 figs. Lancaster, Pa., 1941.

Matheson (R.). **A new Species of Tick,** *Ornithodoros anduzei* **(Ixodoidea, Argasidae) from Bat Caves in Venezuela.**—*Bol. Ent. venezol.* **1** no. 1 pp. 3–5. Caracas, 1941. (With a Summary in Spanish.)

Anduze (P. J.). **Lista provisional de los zancudos hematofagos de Venezuela (Diptera : Culicidae).** [A provisional list of the Blood-sucking Mosquitos of Venezuela (including three new Culicini briefly characterised in footnotes.)]—*Bol. Ent. venezol.* **1** no. 1 pp. 6–18. Caracas, 1941.

Wolcott (G. N.). **A Supplement to "Insectae Borinquenses".**—*J. Agric. Univ. P. Rico* **25** no. 2 pp. 33–158, 33 refs. Río Piedras, P.R., 1941. [*Cf. R.A.E.*, B **24** 314.]

van Emden (F. I.). **Keys to the Muscidae of the Ethiopian Region : Scatophaginae, Anthomyiinae, Lispinae, Fanniinae.**—*Bull. ent. Res.* **32** pt. 3 pp. 251–275. London, 1941.

Hughes (T. P.), Jacobs (H. R.) & Burke (A. W.). **A Survey of Yellow Fever Immunity in Uganda.**—*Trans. R. Soc. trop. Med. Hyg.* **35** no. 3 pp. 131–142, 2 maps, 11 refs. London, 1941.

To investigate the distribution of immunity from yellow fever in man in the Uganda Protectorate [*R.A.E.*, B **30** 76], 3,941 specimens of serum from 49 localities were studied. The results, which are given in a table, gave no evidence of previous or present infection in the eastern, central or south-western portions of the Protectorate, but in the north and west, regions adjoining areas outside Uganda where the incidence of yellow fever is known to be high, there was shown to be a low incidence of immunity, which does not reflect present infection. In Bwamba County, Toro District, where the most extensive investigations were made, 8·9 per cent. of the population was immune. Most of the positive sera were obtained from settlements on the border of the Bwamba Forest, a continuation of the Ituri Forest of the Belgian Congo. In all areas where there was extensive immunisation, there was a marked difference in the degree of immunisation between adult and child groups, the rate for adults being almost 10 times that for children under 14. This may be explained by a change in habit at maturity that increases risk of infection or by an extensive wave of infection over 15 years ago resulting in persistent residual infection. J. O. Harper found that *Aëdes simpsoni*, Theo., and *Eretmapodites chrysogaster*, Grah., which are known to be capable of transmitting yellow fever, occur in relatively large numbers in the Bwamba Forest. They represented 12·2 per cent. of a sample of 252 mosquitos caught there with human bait, and 97·2 per cent. of the mosquitos caught in banana plantations near dwellings were *A. simpsoni*. *A. aegypti*, L., has been observed but rarely. The sera of one out of five wild monkeys (*Cercopithecus*) caught in Bwamba was protective against the virus. Extensive attempts to isolate the virus from man were unsuccessful, and no characteristic lesions were observed in 150 post-mortem examinations of liver tissue.

Gibbins (E. G.). **Notes on Ethiopian Simuliidae. III.**—*E. Afr. med. J.* **18** no. 7 pp. 210–218, 2 refs. Nairobi, 1941.

This paper, which is concerned mainly with distribution, includes new records for 19 species and two varieties of *Simulium* from the Belgian Congo, the Gold Coast, Kenya, the Cape Province of South Africa, the Sudan, Sierra Leone, Tanganyika and Uganda. Diagnostic characters are given for adults and pupae of *S. copleyi*, sp. n., from Kenya, and *S. hessei*, sp. n., from the Cape Province, and for pupae of *S. alcocki* var. *henrardi*, n., from the Belgian Congo and Uganda. The other species dealt with include *S. alcocki*, Pomeroy, which has been observed to feed on fowls and was taken in the Belgian Congo, and five species that suck human blood. A breeding place of *S. damnosum*, Theo., in Tanganyika is recorded for the first time, and new records for this species from Uganda include Bwamba, where the author lived for six months in the bush without being bitten. Adults were caught biting in new districts in Tanganyika, Sierra Leone and the Gold Coast. *S. bovis*, De Meillon, is recorded for the first time in Uganda. *S. neavei*, Roub., the breeding place of which is unknown, was taken in Kenya and Tanganyika when onchocercosis due to *Onchocerca volvulus* was prevalent [*cf. R.A.E.*, B **28** 209]. The immature stages of *S. adersi*, Pomeroy, were found commonly on the blades of grasses in swiftly flowing rivers in Uganda, where it also breeds in the rough waters of a lake. There are new records of *S. medusaeformis*, Pomeroy, in Kenya and Tanganyika.

Flock (R. A.). **Biological Control of the Brown-banded Roach.**—*Bull. Brooklyn ent. Soc.* **36** no. 4 pp. 178–181, 6 refs. Lancaster, Pa., 1941.

Anastatus blattidarum, Ferrière, which was described [as an egg-parasite of an unidentified cockroach] from Khartoum, Sudan [*R.A.E.*, A **18** 425] and has

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not been recorded elsewhere was found to be parasitising egg-capsules of the brown-banded cockroach [*Supella supellectilium*, Serv.] in Arizona in 1939 and appears to be very effective in decreasing the numbers of the host. It would not attack the oothecae of *Latiblattella lucifrons*, Hebard, *Periplaneta americana*, L., *Blattella germanica*, L., or *B. vaga*, Hebard, and it is concluded that it was introduced into the district with *S. supellectilium* from either the eastern United States or Mexico and, originally, from Africa. The adults of both sexes are described. They are inactive in cold weather, but may be found at almost any time of the day or year on walls or furniture or in other places where the egg capsules of the host are likely to be. It is only occasionally seen on the outside of houses, and is normally carried from house to house with the oothecae. Parasitised capsules have a distinctive appearance. The partition walls between the eggs are eaten away and the outer case left intact, and the larvae and pupae can be seen lying in all directions inside. They emerge through a small round hole at one end. The number of parasites observed to emerge from one egg case varied from 4 to 16. Even 4 larvae usually destroyed all the eggs. One egg case may be repeatedly attacked by the same or different females, and the number of emerging adults is determined at least in part by larval competition. The average numbers of males and females per egg case were 1·5 and 9·2, respectively. Unfertilised females produced males. At a constant temperature of 82°F., the average length of the development period was 32·6 days.

Ollerenshaw (R. G. W.). **A Portable Steam Field Disinfestor.**—*J. R. Army med. Cps* **77** no. 5 pp. 245–253, 2 figs., 4 refs. London, 1941.
Wybourn (J. T.). **Drum Portable Disinfector.**—*T. c.* pp. 261–264, 4 figs.

In the first paper, a description is given of a portable steam apparatus for treating clothing or blankets infested with lice [*Pediculus humanus*, L.] and scabies [*Sarcoptes scabiei*, DeG.]. It is compact enough to be moved easily, simple to use and made of easily available materials. A ten-gallon oil drum is used as a boiler as this is adequate to provide steam for any container up to the size of a 150-gallon wine cask ; it rests on a firebox of stout sheet metal from which it is separated by a baffle-plate. The articles to be treated are contained in a large barrel into which the steam is delivered by a feed pipe. A layer of tightly stretched blanket is nailed to the inside of the barrel so as to leave an air-space between it and the wall and provide some insulation. The whole can be entirely dismounted and packed within the barrel, and parts liable to burn out are easily replaced.

A special feature of this apparatus is the arrangement of the pipe for the steam. It leaves the boiler near the top, and is carried downwards and horizontally below it in the form of a U in which the steam becomes superheated. It is prolonged when it enters the barrel so that it discharges the steam upwards directly against the centre of the lid. In similar types of apparatus where the steam does not enter the barrel in this way, there is a tendency for an air-pocket to form near the top at a point opposite the entry of the pipe, and through this a few lice on the top article may survive and re-infest an otherwise successfully treated batch. The superheating is required, not in order that the steam may enter the barrel in a superheated condition, which lowers its effectiveness, but so that it may reach the barrel at or just above boiling point, the additional heat having served to compensate for the loss due to cooling in the pipe. It is important, for full effectiveness of treatment, that the steam condense in the barrel so that it yields its 537 calories per gm. of latent heat and by its great contraction produces a partial vacuum that draws more steam into the barrel and increases the degree to which it penetrates the articles treated. It is probable that control of lice can be ensured if 10 minutes are allowed to elapse after cloud comes freely from the perforated bottom of the barrel.

In the second paper, a smaller and simpler apparatus is described in which a five-gallon drum is the boiler and a fifty-gallon drum the container for the articles to be treated.

BUSVINE (J. R.) & BUXTON (P. A.). **A new Method of controlling the Head Louse.**—*Brit. med. J.* 1942 no. 4240 pp. 464–466, 2 refs. London, 1942.

Mellanby's findings regarding the high incidence of head lice [*Pediculus humanus capitis*, DeG.] in cities in England [*R.A.E.*, B **29** 99] have been confirmed by the observations of others. Figures at the authors' disposal indicate that in industrial areas the incidence in young women is about 30–50 per cent. An essential point in their control among persons who have to live among others who are infested is the provision of an insecticide that will remain effective in the hair for a considerable period so as to give protection from reinfestation. Most of the substances commonly used are volatile, make the hair sticky and probably have no effect on eggs. Living lice or eggs were found in the hair of 10 out of 12 women treated with kerosene and of 7 out of 9 treated with phenol (1 : 40). In each case a bathing-cap was worn for an hour after the application was made.

An account is given of experiments with three insecticides that were found to have great advantages over all others with which the authors are acquainted. These are 25 per cent. technical lauryl thiocyanate or 50 per cent. lethane 384 special in a white oil and derris cream. The technical lauryl thiocyanate comprised 60 per cent. lauryl (dodecyl) thiocyanate and 40 per cent. of certain homologues, the lethane 384 special was composed of 12·5 per cent. N-butyl carbitol thiocyanate, 37·5 per cent. beta-thiocyanoethyl laurate and 50 per cent. refined paraffin, and the derris cream was prepared from a solution of derris extract in castor oil emulsified to make a cream containing 1 per cent. rotenone and 7 per cent. of derris extract. The dosage for any of these varies from 0·5 drachm for a child with short hair to 2 drachms for a woman with long thick hair. This is enough to cover the whole scalp. Saturation of the hair is unnecessary. The head should not be washed for 10 days after treatment. Successful results were obtained in the experiments with the three insecticides in the proportions recommended, live lice or eggs being found after treatment sometimes in less than 2 per cent. of the cases and always in less than 9 per cent., except in a batch of evacuees from a Mediterranean country who refused to co-operate because they regarded the presence of the lice as normal and sometimes washed the children's heads as soon as they had been treated and even deliberately reinfested them. When concentrations were reduced, the proportion of failures increased considerably. No ill effects or discomfort were caused to large numbers of volunteers by the applications of the thiocyanates or the derris cream at the recommended strengths.

KAPUR (H. R.). **Experiments on the Transmission of Rinderpest through the Agency of *Tabanus orientis*, with Remarks on the Feeding Habits of this Fly.**—*Indian J. vet. Sci.* **11** pt. 2 pp. 84–93, 2 graphs, 11 refs. Delhi, 1941.

The literature on the transmission of rinderpest is reviewed, and an account given of experiments carried out at Mukteswar mostly in 1939, on the ability of *Tabanus orientis*, Wlk., to act as a vector of the disease [*cf. R.A.E.*, B **24** 134]. Adults taken in nature and starved for 24–48 hours were partly fed in batches on cattle artificially infected with rinderpest and allowed to complete their feed on one or other of two healthy animals within a few seconds. One of the latter did not develop the infection, although it was subjected to the bites of 821 flies and was subsequently proved to be susceptible. The other was subjected to the bites of only 54 flies but developed typical symptoms of rinderpest and died. Post-mortem examination revealed typical lesions of rinderpest.

In laboratory observations on the feeding habits of *T. orientis*, only 7 out of some 150 flies could be induced to take more than one complete feed, but flies that were interrupted during a blood-meal readily resumed feeding several times. It took a much shorter time to induce flies to feed on a black animal than on a brown one. About 30 observations in the field indicated that this Tabanid usually makes an uninterrupted feed until it is fully engorged. It is therefore improbable that it plays any important part in the spread of rinderpest. The virus remained viable in the body of the fly for at least 30 hours after laboratory feeding on infected animals but was inert after 48 hours.

PANDE (P. G.). **A natural Case of Cutaneous Leishmaniasis in a Bullock in Assam.**—*Indian J. vet. Sci.* **11** pt. 2 pp. 98–104, 4 pls., 24 refs. Delhi, 1941.

A clinical and histopathological description is given of a case of ulcerative dermal leishmaniasis that occurred naturally in a bullock in an area in Assam where kala-azar is endemic. It was impossible to make laboratory investigations on the identity of the parasite concerned, but epidemiological considerations make it probable that it was *Leishmania donovani*. *Phlebotomus argentipes*, Ann. & Brun., the vector of *L. donovani* [*R.A.E.*, B **29** 85] is abundant in the endemic centres of kala-azar in Assam and Bengal where, according to Lloyd, Napier & Smith, it feeds on cattle in preference to man [**13** 124]. No case of cutaneous leishmaniasis caused by *L. tropica* has been known to occur in India south-east of a line joining Bombay and Delhi.

HOWELL (D. E.), SANBORN (C. E.), ROZEBOOM (L. E.), STILES (G. W.) & MOE (L. H.). **The Transmission of Anaplasmosis by Horseflies (Tabanidae).**—*Tech. Bull. Okla. agric. Exp. Sta.* no. 11, 23 pp., 17 refs. Stillwater, Okla., 1941.

Cases of anaplasmosis of cattle that cannot be traced to mechanical transmission often occur in Oklahoma in the summer months [*R.A.E.*, B **20** 205], when the usual tick vectors are inactive. An account is here given of experiments carried out over a period of 11 years on the transmission of anaplasmosis from acute cases (with more than 1 per cent. of the erythrocytes showing marginal bodies) and carrier animals (those that no longer show microscopic evidence or clinical symptoms of the disease) to healthy ones by immediate and deferred transfer feedings by Tabanids [*cf.* **20** 205; **21** 224; **25** 6; **28** 204; **30** 65], which are active at this time and epidemiologically appear probable vectors. In 15 of the experiments in which transfer was immediate, the test cow definitely developed the disease after receiving 13–170 bites, but the disease was not transmitted through bites made from five minutes to 21 days after the infective feed, despite the use of large numbers of flies. The flies that transmitted the disease belonged to seven species of *Tabanus*, and there is little reason to believe that any species of this genus cannot act as a vector if it is able to draw blood. Results with *Silvius pollinosus*, Will., and *Chrysops* sp. were negative. The mouthparts of Tabanids are described and shown to be well adapted to spreading blood diseases. It is concluded that Tabanids may be important vectors of anaplasmosis among animals in the same herd, but that in view of the apparent necessity for immediate transfer, they can have little influence on the spread of the disease to animals at a distance. The scarcity of cases directly attributed to Tabanids may be explained by the fact that more bites were required to transmit the infection from a carrier than from an acute case, so that a concentration of Tabanids sufficient to spread anaplasmosis from carriers cannot be built up until the fly season is fairly well advanced, and this, combined with the length of the incubation period of the disease, makes the clinical cases appear after the fly population has begun to decrease, when there

are seldom enough flies to spread the disease even from such cases. Occasional outbreaks may be explained by the development of clinical cases early in the season as a result of transmission by ticks or mechanical means.

COVELL (G.). **Antimalaria Operations in Delhi. Part III.**—*J. Malar. Inst. India* **4** no. 1 pp. 1–13, 14 pls., 3 maps, 3 refs. Calcutta, 1941.

The following is substantially the author's summary of this third paper of a series [*cf. R.A.E.*, B **27** 207; **28** 161]. Details are given of the permanent engineering works carried out in the Delhi urban area since 1936 to abolish Anopheline breeding places. The programme has now been completed except for one major project. In planning the works, schemes for areas where satisfactory control by temporary measures was impossible were given priority. The remaining cases were examined to determine whether they would be more economically dealt with by permanent works or by the use of recurring measures indefinitely, and those falling into the latter category were deleted from the programme. The general principle adopted was to prevent flooding from any source over the whole inhabited area and for at least half a mile beyond its limits. The area so protected is levelled and dressed so as to drain away local rainwater completely, or, where this is not possible, to direct it into reservoirs excavated for the purpose. In certain sections in or very near built up areas, extensive filling operations were carried out, which often provided valuable building sites and in other cases enhanced the value of house property. Heading up of water in stormwater drains discharging into the river was reduced to a minimum by raising their outfalls to the highest level compatible with a gradient sufficient to secure an adequate flow. Other works include the remedying of defects in the underground stormwater drainage system, the mosquito-proofing of cisterns, the filling or covering of wells and the abolition of road siphons. The cost of the works already completed is discussed.

VISWANATHAN (D. K.). **Experimental Malaria Control in a hyperendemic Tea Garden in Upper Assam by the Use of Pyrocide 20 as an insecticidal Spray.**—*J. Malar. Inst. India* **4** no. 1 pp. 35–55, 1 map, 8 graphs, 5 refs. Calcutta, 1941.

An account is given of an experiment on the control of malaria by spraying weekly against Anophelines in houses with a pyrethrum extract (Pyrocide 20) in kerosene (1 : 19) [*cf. R.A.E.*, B **26** 180; **28** 92] carried out in 1940 on a tea estate in Upper Assam where malaria is hyperendemic and *Anopheles minimus*, Theo., the sole vector. Out of 599 coolies' houses, 244 in one area were sprayed and the remainder left as controls. The spraying was carried out between 5 and 8 a.m. at the rate of about 15–20 houses per hour. The underside of the eaves was sprayed before the interior of the houses, and complete closure was not possible or attempted. About 1 gal. of the mixture was used per 225,300 cu. ft. or 33,700 sq. ft. of floor space. The cost is discussed.

Figures given for the annual admissions of malaria cases to hospital in each year from 1933 and the number of cases per thousand of the population show that the incidence of malaria on the estate is very high, though it has fallen considerably since 1936. The fall may have in some measure been due to an attempt to deepen the lower reaches of the main jhan (ravine stream), administration of quinine to the children and treatment of fever cases. From a continuation of the curve representing the malaria incidence in 1933–39, the anticipated incidence in 1940 was 500 per thousand, whereas the observed incidence was only 316 per thousand. Spraying, however, was not begun until April, and the figures for the first three months consist mostly of relapses. The corresponding figures for the period April to December were 480 and 250. Monthly records of hospital cases show no significant difference between the

incidence in the sprayed houses and that in the unsprayed ones. This might be attributed to constant dispersal of mosquitos between the sprayed and unsprayed areas, or to progressive diminution in the output of the vector, but the engorged females are sluggish, and the catches of larvae and adults recorded throughout the experiment do not warrant the acceptance of the latter hypothesis. It is thought possible that a smaller proportion of cases seeks hospital treatment in the unsprayed than the sprayed areas.

The malaria index in infants less than one year old in the sprayed area was nearly double that in the unsprayed area in April, only half of it in September and November and about three-fifths of it in December. The index in the sprayed group dropped by 60 per cent. from April to September, and by about 40 per cent. from April to December, while in the unsprayed group, it rose by 50 per cent. from April to September, and 95 per cent. from April to December. If the index in the unsprayed group truly reflects the seasonal hazard, the indices observed in the sprayed group in September and December represented reductions of 75 and 70 per cent., respectively. The parasite indices in children 2–10 years old and in adults fell from 50·6 and 13·3, respectively, in January to 27·2 and 4·9 in December in the sprayed group, while in the unsprayed group they remained almost constant or rose slightly.

The 4,022 adult Anophelines caught in the houses comprised 1,717 of *A. minimus*, 1,432 of *A. vagus*, Dön., 737 of *A. annularis*, Wulp, and very small numbers of six other species ; and of the 10,202 larvae caught, 1,515 were *A. minimus*, while *A. hyrcanus*, Pall., and *A. annularis* were the most prevalent species. Adult infestation was high in July, August and September, and there was no evidence of any progressive decrease in the numbers of larvae or adults as a result of continued spraying. There was a higher density of adults of *A. minimus* in unsprayed than in sprayed areas, and only two gland infections were met with in 421 females of this Anopheline dissected in the sprayed area, while 3 gut and 10 gland infections were encountered in 705 dissected in the unsprayed area, so that the infection rates were 0·05 and 1·84 per cent., the difference being significant.

SENIOR WHITE (R.). **Observations on the adult Habits of *Anopheles fluviatilis* and *Anopheles varuna*.**—*J. Malar. Inst. India* **4** no. 1 pp. 57–62, 4 refs. Calcutta, 1941.

A summary is given of data collected on the habits of adult Anophelines of the *funestus* group, represented by *Anopheles fluviatilis*, James, and *A. varuna*, Iyen., in the Satpura Ranges [*cf. R.A.E.*, B **29** 145] and in Madras near Vizagapatam. In the Satpuras, a house for a collector was built near an isolated hut for a track-maintenance gang on the Bengal-Nagpur Railway. The hut is about 1,100 yards from the nearest village. There were 12 rooms with a population of 11 and no animals at the site. The collector, sleeping within a trap-net, made collections from it at 2 and 6 a.m., and most of the rooms were searched for resting adults after daylight. One-third of the 206 individuals of *A. fluviatilis* caught in the trap-net from September to November were taken at 2 a.m., when they were undoubtedly attempting to feed, and they had a malaria oöcyst rate of 4·4 per cent., while those taken at 6 a.m. had a rate of 2·9 per cent. The only specimen with gland infection was taken at 6 a.m. Two of the 10 individuals of *A. varuna* taken in the trap-net in September and October were taken at 2 a.m. *A. varuna* formed only 4 per cent. of the members of the *funestus* group taken in 1940 [*cf.* **29** 146], and it is concluded from this and from other data that local conditions in that year must have been unfavourable for its breeding. *A. fluviatilis* appeared to be more plentiful than in 1939. If the entire population belonging to the *funestus* group rested indoors by day and there was no infiltration from the village, daily catching should eliminate all sporozoite

carriers. However, it did not do so, there being 27 sporozoite infections to 38 oöcyst infections, so that, unless all the sporozoite vectors were resting in the relatively few rooms that could not be searched (an average of 2·5 daily), much resting by *A. fluviatilis* at least must occur out of doors. *A. varuna* was too rare for conclusions to be drawn about it. In future work, all rooms should be searched daily, and if outside resting is thus proved, all grass and undergrowth should be cleared from round the area for an increasing distance and the effect watched on the resting habits and numbers of the two species collected.

Around Vizagapatam, *A. varuna* breeds profusely, yet the spleen rate remains very low, as members of the *funestus* group are hardly ever taken in houses. *A. varuna* formed 65·4 per cent. of the total Anopheline catch in cattle-sheds in one area between February and August and 4·5 per cent. of the catch in another area for the whole year. The difference is due to the fact that the attraction of cattle-sheds for this species is largely confined to one type, a cone-shaped structure of palmyra-thatch carried down almost to the ground, which is common but not general in the district. *A. varuna* comprised 4,603 of the 6,078 female Anophelines caught in one such shed converted into a trap by carrying the thatching down to the ground and closing the door with a net at dawn. The local vector of malaria is not known, but *A. varuna* appears to be purely a cattle feeder, and all dissections of it were negative. It may be that *A. fluviatilis* or *A. minimus*, Theo., is the vector or that it is a species of another group such as *A. stephensi*, List. Sporozoites have recently been found in 3 out of 11 specimens of *A. s. mysorensis*, Sweet & Rao, during an epidemic in the neighbourhood. The maxillary indices of females of *A. varuna* from Vizagapatam and from Deltaic Bengal, where it is known to be a vector [**28** 93], did not differ significantly. Slight morphological differences were observed between specimens from the Satpuras and those from the coast.

THOMSON (R. C. M.). **Studies on the Behaviour of *Anopheles minimus*. Part IV. The Composition of the Water and the Influence of organic Pollution and Silt.**—*J. Malar. Inst. India* **4** no. 1 pp. 63–102, 4 pls., 3 figs., 38 refs. Calcutta, 1941.

The following is based on the author's summary of this fourth paper of a series on the behaviour of *Anopheles minimus*, Theo. [*cf. R.A.E.*, B **29** 68] in which observations on the influence of the composition of the water, organic pollution and silt made at Tocklai in Upper Assam are discussed. The methods used are outlined. The composition of water from normal breeding places was compared with that of water in which *A. minimus* seldom breeds. A perennial river, the principal cold-weather breeding place, was compared with fresh-water reservoirs, while monsoon breeding places such as tea-garden drains were compared with stagnant rain-filled rice-fields. There was no constant difference between the dissolved oxygen content of river water and of reservoir water, either by day or night. Free and saline ammonia were seldom present in more than a trace in any of the different kinds of water, and testing for them was, therefore, useless. The albuminoid ammonia and the Tidy figure (oxygen absorbed from permanganate), which gave an estimate of the organic matter and the degree of pollution, were found to give the most valuable indications of the suitability of water for breeding. Both these figures were lower in the type of water regularly selected by *A. minimus* than in standing water. The degree of pollution as estimated by a formula used in public health work was 3·7 times as great in reservoirs as in river water, and 3 times as great in rice-fields as in garden drains. When a river comes down in flood, there is a great increase in the degree of pollution, and there is no longer a constant difference between river and reservoir water. The figures in general during the hot wet period were much higher than during the cool season.

In laboratory experiments, gravid females failed to distinguish between water from their normal breeding places and water in which they do not usually breed, despite the difference in composition, which had moreover no marked effect on the growth and mortality of larvae. Chemical studies of the pollution of water by cut or decaying vegetation [**25** 46, etc.] were carried out in the laboratory and in the field. The results showed that the course and degree of pollution can be followed by either the test for albuminoid ammonia or the Tidy figure or both in conjunction ; of the two, the Tidy figure is the better single indicator of vegetable pollution. Free and saline ammonia were again usually absent and nitrite was completely absent. It was shown that dissolved oxygen might remain high even when there was a great increase in albuminoid ammonia and Tidy figure. Vegetable pollution of a breeding place of *A. hyrcanus*, Pall., failed to make the water unsuitable, and eggs of this species were laid at the height of pollution when a thick scum had formed on the water, which was very foul smelling, but laboratory experiments with *Eupatorium* showed that *A. minimus* is very sensitive to it, gravid females being able to distinguish high dilutions of rotting vegetation. Larvae, on the other hand, developed successfully in water with a degree of pollution over 30 times greater than that avoided by the females. The sensitivity of the gravid female must therefore be the deciding factor in control by vegetable pollution or herbage packing. These findings are supported by a detailed study of pollution of tea-garden drains by factory effluent (wastings from tea rollers), which also showed that the avoidance of polluted water is not a simple olfactory response ; it was found in the laboratory that the later products of decomposition are not so repellent as the earlier ones. Herbage packing experiments showed that *Eupatorium* loses its power of rotting in water in the dry season. Field experiments showed also that *A. minimus* will lay eggs in very silty water and that successful development and growth of larvae can take place in it. Laboratory experiments support these findings, and show that silt, in itself, has no marked lethal effect on larvae of *A. minimus*. In rivers, the natural controlling effects usually attributed to silt are more likely to be due to the simultaneous increase in current velocity.

CLARK (R. H. P.) & CHOUDHURY (M. A.). **Observations on *Anopheles leucosphyrus* in the Digboi Area, Upper Assam.**—*J. Malar. Inst. India* **4** no. 1 pp. 103–107, 2 pls. Calcutta, 1941.

Meteorological records for 1938 and 1940 for the Digboi area of the Lakhimpur District, Assam, are given in a table, together with the percentage incidence of malaria among the employees of an oil company working in the area. It is about 10 sq. miles in extent, flat, well drained, grassed and largely built over, and encroaches into dense hilly jungle, opens on to rice land, and is separated from the forest by a hilly bordering zone in which there are many bungalows, and in which *Anopheles minimus*, Theo., has been under control for some years and is now seldom found. The Kharjan area is a section of road a mile long traversing dense forest about three miles from Digboi and opened in late 1938. About 40 families have settled along it, and it was first examined in May 1940. In June, all the children had enlarged spleens. There were 2 gut and 2 gland infections and 1 gut and gland infection in 135 females of *A. leucosphyrus*, Dön., dissected in 1938 in the Digboi area, 4 gland infections in 82 dissected in 1940 in the same area, and 6 gut and 13 gland infections and 1 gut and gland infection in 642 dissected in 1940 in the Kharjan area. The total infections for *A. minimus* for the same years and districts were 9, 3 and 1 for 277, 98 and 33 dissections, respectively. Adult catches were made in the mornings. *A. leucosphyrus* was found in dwellings, often inside mosquito nets, but never in cow-sheds that were searched twice a week from June to August in 1940, and males were never taken. In the Digboi area, it was most common in the hilly border zone. The larvae were found in small collections of stagnant water in open jungle, such as

small pools and footprints of elephants. Dense jungle was not thoroughly investigated. No larvae were found in completely unshaded areas or in running water or in partly shaded or open reservoirs. As it was more plentiful than *A. minimus* and the sporozoites were judged to be of the human type, it is concluded that *A. leucosphyrus* is an important local vector.

CHOPRA (R. N.), ROY (D. N.) & GHOSH (S. M.). **The insecticidal and larvicidal Action of the Essential Oils of** *Ocimum basilicum* **(Linn.) and** *Ocimum sanctum* **(Linn.).**—*J. Malar. Inst. India* **4** no. 1 pp. 109–112, 5 refs. Calcutta, 1941.

In continued investigations on the effectiveness of Indian plants reputed to have insecticidal properties [*cf. R.A.E.*, B **29** 150], the essential oils from leaves of *Ocimum basilicum* and two varieties of *O. sanctum* were shown to have some toxicity for adults of *Aëdes aegypti*, L., and *Culex fatigans*, Wied., though it was not comparable with that of pyrethrum. They were only slightly toxic to flies and not at all to cockroaches. Their odour was repellent to *Culex fatigans* and *Armigeres obturbans*, Wlk., but not to *Aëdes aegypti*. They killed mosquito larvae, but the cost of manufacture is too high for them to be of practical importance as larvicides. Fumigation with the dried leaves did not seem to exercise any marked repellent or toxic action on mosquitos.

SEN (P.). **Aquatic Plants in the Ecology of Anopheline Mosquitoes.**—*J. Malar. Inst. India* **4** no. 1 pp. 113–137, 1 pl., 2 figs., 25 refs. Calcutta, 1941.

The following is substantially the author's summary. Anopheline breeding and emergence in relation to the presence of 12 species of aquatic plants were studied between February 1936 and January 1937 in reservoirs in four villages in Lower Bengal, where malaria is endemic, and also, for one species of plant, in a comparatively healthy area between November 1934 and September 1935. *Anopheles hyrcanus* var. *nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. ramsayi*, Covell, *A. annularis*, Wulp, *A. philippinensis*, Ludl., *A. pallidus*, Theo., *A. jamesi*, Theo., *A. subpictus*, Grassi, *A. vagus*, Dön., *A. varuna*, Iyen., *A. aconitus*, Dön., and *A. culicifacies*, Giles, bred in and emerged from waters containing these plants. The presence of *Pistia stratiotes*, *Ceratophyllum demersum* and *Spirogyra* sp. was compatible with heavy breeding of several species of Anophelines, and the proportion of adult emergences from reservoirs containing these plants was high. The emergence rate was very low in association with *Utricularia flexuosa*, *Ottelia alismoides*, *Najas foveolata* and *Hymenachne myurus*, although the numbers of Anopheline larvae found among them were not small. *Lemna minor*, when growing thickly, appeared to be detrimental to breeding; *A. subpictus* and *A. vagus* were the species chiefly associated with it. *A. ramsayi* was found almost exclusively in association with *Pistia*, and *A. hyrcanus* also appeared to have a strong preference for breeding places containing this plant, while it seemed to avoid *Ceratophyllum* and *Hydrilla verticillata* where other vegetation was present, though like *A. subpictus* it was associated with every kind of vegetation studied. Waters containing *Hydrilla*, and next to this those containing *Ceratophyllum*, were the most frequented by larvae of *A. annularis*. Larvae of *A. philippinensis* were recorded from water containing all the types of plants studied except *Lemna*, but were most frequently associated with *Spirogyra* sp. *A. subpictus* was also frequently associated with this type of vegetation. Larvae of *A. pallidus* were most frequently found in association with *Utricularia*. The fact that virtually no adults of this species emerged in the area may be due to the destructive action of the plant on the aquatic stages. *A. aconitus* showed a special predilection for water containing *Eichhornia speciosa*. With regard to the number of different species of Anophelines associated with each type of plant, *Pistia*

stands first, closely followed by *Eichhornia*, *Spirogyra*, *Limnanthemum*, *Ipomoea* and *Najas*, but *Hydrilla* and *Najas* supported the densest larval populations.

Sen (P.). **Distribution of *Anopheles sundaicus* Rodenw. through mechanical Means.**—*J. Bombay nat. Hist. Soc.* **42** no. 3 pp. 593–598, 1 map., 5 refs. Bombay, 1941.

The transport of *Anopheles sundaicus*, Rdnw., to Calcutta from its breeding places in the Sunderbans by train and country boat [*cf. R.A.E.*, B **20** 215 ; **24** 164] during 1933 and 1934 is recorded. Collections made from 234 trains at the terminal railway stations in Calcutta that have connections with the outlying breeding zones included 101 individuals of *A. sundaicus*, taken in 35 trains, as well as several other species that do not transmit malaria in the area involved. Those identified were *A. hyrcanus*, Pall., *A. barbirostris*, Wulp, *A. annularis*, Wulp, *A. ramsayi*, Covell, *A. philippinensis*, Ludl., *A. vagus*, Dön., *A. subpictus*, Grassi, *A. varuna*, Iyen., *A. aconitus*, Dön., and *A. stephensi*, List. Of 3,062 country boats arriving at Calcutta after passing through areas infested with *A. sundaicus*, 136 carried a total of 142 individuals of this species under shelter of the cargo, and *A. subpictus*, *A. vagus* and *A. varuna* were also found in them. The most favourable resting places were in cargoes of rice, jute and straw. Dispersal in trains was most noticeable between June and September and by boat from July to December. It is thought that the establishment of *A. sundaicus* in the Salt Lake area to the east of Calcutta [*cf.* **24** 164] has been the outcome of importation in boats, as no trains stop near the Salt Lakes.

Carr (H. P.), Fernández Meléndez (J.) & Fernández Meléndez (A.). **Malaria Reconnaissance of the Province of Camagüey in Cuba.**—*Amer. J. trop. Med.* **21** no. 6 pp. 739–750, 1 map, 5 refs. Baltimore, Md., 1941.

The results obtained in Camagüey Province in the course of a malaria survey of Cuba [*cf. R.A.E.*, B **28** 121] are given in this paper. The spleen rate was high in most areas, particularly those where natural drainage was poorest, but the low incidence of blood parasite infections indicated that there had not been much recent transmission, and no evidence of epidemic conditions was found. Epidemics occur periodically in years that are favourable for Anopheline breeding. In the city of Camagüey, the high spleen indices were all in the periphery. Practically all the Anopheline breeding responsible for the maintenance of endemic malaria in the city occurs in borrow pits in the suburbs, and the species concerned is *Anopheles albimanus*, Wied. It would not be very difficult to drain these pits. *A. albimanus* was taken in large numbers in a larval survey of the whole Province and is most abundant in the areas of heaviest malaria incidence and at the transmission season. The only other larvae collected were 71 individuals of *A. crucians*, Wied., and 19 of *A. vestitipennis*, D. & K.

Boyd (M. F.). **The comparative Susceptibility of two Strains of *Anopheles quadrimaculatus* to Infection with Human Malaria Parasites.**—*Amer. J. trop. Med.* **21** no. 6 pp. 751–753. Baltimore, Md., 1941.

Batches of *Anopheles quadrimaculatus*, Say, belonging to strains that had originated in localities in Florida and Alabama about 300 miles apart, were allowed to engorge on infectious malaria patients and were then incubated for 7–12 days at about 20°C. [68°F.]. Examination of their stomachs for oöcysts showed no significant difference in the susceptibility of the strains to either *Plasmodium falciparum* or *P. vivax*. Infections resulted from all applications,

and usually the qualitative incidence of infection [*R.A.E.*, B **30** 84] was high. There appeared to be a slightly greater degree of quantitative infection among the Anophelines of the Florida strain.

COGGESHALL (L. T.). **Strains of *Anopheles quadrimaculatus*. Inheritance of Color Patterns in the Larvae of *Anopheles quadrimaculatus*.**—*Amer. J. trop. Med.* **21** no. 6 pp. 755–765, 3 graphs, 2 figs., 8 refs. Baltimore, Md., 1941.

In view of the possibility of observed differences in the colour pattern on the dorsal surface of larvae and pupae of *Anopheles quadrimaculatus*, Say, being hereditary and related to susceptibility to malaria infection, experiments were begun in 1940, which resulted in the segregation of two strains, one with a broad white stripe on the larvae and pupae and one without it. The technique connected with the maintenance of the colonies, which were kept in identical conditions, is described in detail. Each colony was started in February 1940 with 200 pupae selected from a parent colony that produced an approximately equal number of striped and unstriped larvae, and in each generation pupae that did not conform to the original pattern were counted and destroyed. The proportion changed rapidly at the beginning of the experiment in both colonies, so that within a few weeks there were over 90 per cent. striped pupae in one colony, and a corresponding percentage of unstriped ones in the other. From that time, the change was progressive but slower; after 1½ years, occasional nonconforming pupae were still found, though the strains were almost pure. The proportions in the parent colony remained practically constant during several months' observation. No essential differences were found between the eggs and adults of the two selected colonies after they had reached the point where practically all individuals conformed to type, or in the larvae apart from the differential pattern. Experiments showed that the ratio of striped to non-striped larvae and pupae was not influenced by alterations in light, food or temperature. Females of the two strains seemed equally susceptible to infection with *Plasmodium cynomolgi* [*cf. R.A.E.*, B **30** 22] when fed on infected monkeys [*Macacus rhesus*].

RUSSELL (P. F.) & RAMACHANDRA RAO (T.). **On Surface Tension of Water in Relation to Behavior of Anopheles Larvae.**—*Amer. J. trop. Med.* **21** no. 6 pp. 767–777, 1 graph, 13 refs. Baltimore, Md., 1941.

The following is the authors' summary. Details are presented of some experiments conducted to observe the behaviour of *Anopheles* larvae when the surface tension of water is reduced. Larvae fail to cling to the surface when the surface tension reaches a critical range, 27 to 36 dynes. Individual larvae show small differences in behaviour and there does not appear to be any difference in the minimal surface tension requirements of larvae of several species studied. Surface tensions of natural waters do not reach the low minimal ranges required to drown larvae. A study of several types of habitat indicates that surface tension is not a factor determining distribution of species.

VARGAS (L.), CASIS S. (G.) & EARLE (W. C.). ***Anopheles pseudopunctipennis*, Theobald, a Vector of Malaria in Mexico.**—*Amer. J. trop. Med.* **21** no. 6 pp. 779–788, 1 graph, 21 refs. Baltimore, Md., 1941.

The efficiency of *Anopheles pseudopunctipennis*, Theo., as a malaria vector in various countries [*R.A.E.*, B **29** 172] is discussed from the literature. Hoffmann indicated that it was responsible for transmission over a large part of Mexico [*cf.* **20** 209; **26** 17; **27** 81, 122]; and the authors agree that it is so in the southern interior zone, in many parts of which it is the only Anopheline found and where malaria is quite prevalent. Confirmation of this was obtained

in observations made between June 1937 and March 1939 in the State of Morelos. Those carried out at Temixco, a village of some 1,000 inhabitants situated at an elevation of 3,900 ft., are dealt with in this paper. In the autumn of 1937, the spleen and parasite rates for 114 children 5–14 years old were 50·8 and 43·0 per cent., respectively, and the rates in 1938 were not very different. During the last five months of 1937, 152 cases of clinical malaria were seen, and there were 238 in 1938, 16, 38 and 46 per cent. of the parasites found being *Plasmodium malariae*, *P. vivax* and *P. falciparum*, respectively. People of all ages were attacked, but in general the disease was not very severe. All the adult Anophelines caught were *Anopheles pseudopunctipennis*, though an occasional larva of *A. eiseni*, Coq., was found in the deep ravines or shady pools. The principal breeding places were the flooded rice-fields, but breeding in the drier months was maintained also in the algae-covered river and creek beds. Adults were easily found in large numbers in the native houses. They were comparatively scarce in winter, but with the early planting of rice in late February and the enormous increase in potential breeding area, density rose sharply ; it reached the maximum in April and June, and remained high until the end of September. Malaria fever incidence was at its lowest in the latter part of April, and there was a lag of about eight weeks between the rise in mosquito density and in malaria case incidence ; the case incidence continued to rise with a gradual falling off of the mosquito density in the rainy season. A brief account is given of blood preference studies, the results of which have already been noticed [**27** 123].

In experiments carried out in Temixco, there was no difficulty in infecting *A. pseudopunctipennis* with both *P. vivax* and *P. falciparum* [*cf.* **28** 30]. Between 22nd July and 1st October 1937, the glands of 801 mosquitos and the midguts of 526 were examined, and 0 and 12, respectively, found infected. The average number of oöcysts per midgut was 4·5. In the autumn of 1938, glands from 1,246 mosquitos were examined and sporozoites were found in four. It is considered that the mosquito concerned is identical with that described from Panama, the West Indies and New Mexico, but that more studies should be made to determine whether several species are being grouped under one name or whether local conditions alone determine its malaria carrying capacity [but *cf.* **29** 172]. It is possible that it is not a very good vector and is important only when able to reach the high densities possible under certain conditions in Mexico and in Guatemala [*cf.* **24** 291–292].

Ayroza Galvão (A. L.). **Contribuição ao conhecimento dos anofelinos do grupo *Nyssorhynchus* de São Paulo e regiões vizinhas (Diptera, Culicidae).** [A Contribution to the Knowledge of the Anophelines of the *Nyssorhynchus* Group in São Paulo and the neighbouring Regions.]—*Arq. Zool. S. Paulo* **1** pp. 399–484, 18 pls., 28 figs., 5 pp. refs. São Paulo, 1940. (With a Summary in English.) [Recd. 1942.]

This revision of the Anophelines of the *Nyssorhynchus* group in São Paulo was carried out in order to facilitate comparative biological studies of the local forms and their relation to malaria, since the group appears to offer some analogies with the complex of *Anopheles maculipennis*, Mg., and its varieties in Europe. It contains a brief discussion of constant and variable characters in various species and methods of studying them, keys to the eggs, larvae and adults of both sexes of the species that occur there, showing varieties, and notes, partly from the literature, on the characters, distribution and in some cases habits of the various forms. The species dealt with are *A. oswaldoi*, Peryassú, *A. triannulatus*, Neiva & Pinto, *A. strodei*, Root, *A. rondani*, Neiva & Pinto, *A. argyritarsis*, R.-D., *A. albitarsis*, Arrib., *A. darlingi*, Root, *A. pessôai*, Galvão & Lane, and *A. lanei*, Galvão & Amaral, which occur in São Paulo, and a species

[apparently *A. aquasalis*, Curry] to which the author considers the name *tarsimaculatus*, Goeldi, to be applicable [but *cf. R.A.E.*, B **29** 181], and which occurs in northern, but not in southern, Brazil.

A. triannulatus is represented in São Paulo exclusively by var. *davisi*, Paterson & Shannon. Differences were observed in the eggs of *A. strodei*, and since this species also shows local differences in habits, it is considered that distinct varieties may exist. The existence of distinct varieties in *A. albitarsis* and *A. argyritarsis* would also explain differences in the habits of these species, which are domestic in some localities and not in others. The author has been informed by W. H. W. Komp that he has taken *A. pessôai* in Colombia and Venezuela, where it has not previously been observed.

Ayroza Galvão (A. L.). **Contribuição ao conhecimento das espécies de *Myzorhynchella* (Diptera, Culicidae).** [A Contribution to the Knowledge of the Species of *Myzorhynchella*.]—*Arq. Zool. S. Paulo* **2** pp. 505–576, 13 pls., 38 refs. São Paulo, 1941. (With a Summary in English.)

The author discusses the characters and systematic position of *Myzorhynchella*, which he considers a distinct subgenus of *Anopheles* intermediate between *Nyssorhynchus* and *Kerteszia*, to which he also accords subgeneric rank. He points out that the indigenous vectors of malaria in Brazil are species of *Nyssorhynchus*, and possibly of *Kerteszia* in the case of rural malaria, but not of *Myzorhynchella*, which are zoophilous. The characters of the latter require study, however, to permit easy identification by malariologists seeking to control the dangerous vectors. He recognises four species of *Myzorhynchella*, all of which are confined to Brazil, namely *A. lutzi*, Cruz, *A. parvus*, Chagas, *A. nigritarsis*, Chagas, and *A. antunesi*, Galvão & Amaral, which was described from São Paulo in *Nyssorhynchus* (*Folia clin. biol.* **12** no. 5 pp. 150–160. São Paulo, 1940). He transfers *A. pictipennis*, Philippi, which is known only in Chile and Argentina, to *Nyssorhynchus*, and erects a new subgenus, *Arthuromyia*, for *A. gilesi*, Neiva, which was described in *Myzorhynchella*. He gives keys to the adults of both sexes and the larvae of the species of *Nyssorhynchus*, *Myzorhynchella* and *Kerteszia*, those for *Nyssorhynchus* from a paper already noticed [preceding abstract] and those for *Kerteszia* from a paper by Komp [*R.A.E.*, B **26** 17], quotes the original and later descriptions of the species of *Myzorhynchella*, and redescribes them from material collected in São Paulo.

Weyer (F.) & Hundertmark (A.). **Versuche über die Vorzugstemperatur einiger Anophelen bei der Eiablage.** [Experiments on the Oviposition Temperature Preference of some *Anopheles*.]—*Riv. Malariol.* **20** (1) no. 4 pp. 251–257, 5 refs. Rome, 1941. (With a Summary in Italian.)

Temperature preferences in ovipositing Anophelines have rarely been investigated, and Hecht, who showed that *Anopheles claviger*, Mg. (*bifurcatus*, auct.) preferred cooler water than *A. maculipennis*, Mg. [*R.A.E.*, B **19** 142], was not in a position to consider varieties of the latter. Experiments were therefore begun in the spring of 1939 in Hamburg in which females of *A. superpictus*, Grassi (a subtropical species) and of *A. maculipennis* vars. *typicus*, *messeae*, Flni., *atroparvus*, van Thiel, and *labranchiae*, Flni., were given the choice of water with temperatures between 15°C. [59°F.] and 36°C. [96·8°F.]; 1,263 egg masses were observed, but the work was not completed. The results obtained showed that temperatures between 26 and 30°C. [78·8 and 86°F.] were preferred more or less equally by all forms, and more egg-batches were found on water at 30°C. than at any other temperature. Some temperatures, however, were not available to some of the varieties.

Brambilla (A.). **L'anofelismo nella zona di Dire Daua (Harar). Prima nota.** [Anophelism in the Neighbourhood of Diredawa. First Note.]—*Riv. Malariol.* **20** (1) no. 4 pp. 271–293, 20 figs. Rome, 1941. (With Summaries in English and German.)

The author carried out observations from March to December 1939 on the Anopheline larvae in breeding places along the main roads for about 60 miles round Diredawa, in Abyssinia. The character and distribution of the breeding places and the seasonal variation in the larvae are described. The species found were *Anopheles gambiae*, Giles, *A. dthali*, Patt., *A. pretoriensis*, Theo., *A. cinereus*, Theo., *A. turkhudi*, List., *A. demeilloni*, Evans, *A. garnhami*, Edw., *A. rhodesiensis*, Theo., *A. coustani*, Lav., *A. squamosus*, Theo., and *A. rivulorum*, Leeson.

Chabelard (R.). **La diagnose différentielle des larves de *Anopheles multicolor* et de *A. hispaniola*.**—*Bull. Soc. Hist. nat. Afr. N.* **32** no. 5–7 pp. 242–244. Algiers, 1941.

Examination of 46 larvae of *Anopheles hispaniola*, Theo., and 188 of *A. multicolor*, Camb., classified according to size and to the relation between the length of the head and the width of the chitinous collar showed that the characters of the mesothoracic pleural bristles are constant [*cf. R.A.E.*, B **30** 86] in that one is always simple (occasionally forked at the tip) and one branched in *A. multicolor*, while in *A. hispanloa* both are always branched, though the number of branches is related to the age of the larva, being smaller in young larvae than in those that have reached the fourth instar.

McMahon (J. C.). **A brief Summary of the Results of Tests carried out on certain Oils against Mosquito Larvae.**—*E. Afr. med. J.* **18** no. 8 pp. 240–241. Nairobi, 1941.

Seven samples of used engine oils, five obtained from military transport camps and two from an aerodrome, used at rates equivalent to 24 gals. per acre (twice the rate at which a mixture of 9 parts fuel oil and 1 part solar oil, the standard mixture recommended for the control of mosquito larvae in Kenya [*cf. R.A.E.*, B **23** 234 ; **29** 117] gives complete kill in 90 mins.) had a negligible effect on third- and fourth-instar larvae of *Anopheles gambiae*, Giles, in 90 mins. and gave kills varying from 0 to 90 per cent. in 24 hours. The tests were made on larvae in glass basins in the laboratory and in shallow tanks in the open. The 90 per cent. kill was effected by an aeroplane oil, which was the only sample that had been clarified. The highest kill given by an unclarified oil was 70 per cent. At excessive dosages equivalent to 400–800 gals. per acre, one oil killed 90 per cent. of the larvae in 30 mins., and at 600 gals. per acre, another killed all the larvae in about 5 hours. Much better results were obtained in bright sunshine than on cool days, but, nevertheless, except at impracticably and uneconomically large dosages, these oils cannot be relied upon. Lighting kerosene or power kerosene alone gave complete kill in less than one hour at 4 gals. per acre under laboratory conditions, but did not spread well and lost toxicity rapidly. They were, therefore, unsatisfactory under natural conditions and were, moreover, very expensive. In tests with mixtures of kerosene and used motor oils, mixtures containing less than 50 per cent. kerosene were slow in action, and the results showed clearly that the addition of kerosene to used motor oil in sufficient quantities to produce a satisfactory kill is entirely uneconomic.

Toumanoff (C.). **Note sur un reduvidé prédateur de moustiques en Indochine (*Sycanus falleni* Stål).**—*Rev. méd. franç. Extr.-Orient* **19** no. 3–4 pp. 401–404, 1 pl., 5 refs. Hanoi, 1941.

Reduviids found by the author in dwellings in Cambodia included *Sycanus falleni*, Stål, which was observed to be an important predator on mosquitos,

particularly when it was in the nymphal stage. The nymph and adult are briefly described. Laboratory observations of considerable duration showed that it has a preference for Anophelines. An account is given of the method of catching the prey, which is killed instantly. A nymph taken on 5th September 1940 moulted on 13th September, became adult on 19th October and died on 16th February 1941. During the 164 days that it lived in the laboratory, it consumed about 1,200 mosquitos. A list is given of other Reduviids that have been recorded from Indo-China and may possibly feed on mosquitos.

SULLIVAN (W. N.), GOODHUE (L. D.) & FALES (J. H.). **Application of the Aerosol to Fumigation. I. Stabilization of a Naphthalene Aerosol.**—*J. econ. Ent.* **34** no. 5 pp. 650–653, 1 fig., 11 refs. Menasha, Wis., 1941.

Naphthalene can be vaporised easily and condenses to particles of colloidal dimension, but it rapidly forms large crystals, which settle completely in a few minutes, and it is necessary to prevent this rapid precipitation if it is to be used in the form of an aerosol. Preliminary tests having shown that vaporisation of naphthalene in the presence of an abundance of inert nuclei increased its effectiveness greatly, further investigations were made, using the house-fly [*Musca domestica*, L.] as a biological indicator. Naphthalene melting at 80°C. was vaporised on a hot plate, and smoke was produced by burning a mixture of maize stalks and sodium nitrate (83 : 17) in an open dish immediately before the naphthalene was vaporised. The flies were exposed in 10-inch cubical cages with screen wire on the top and two opposite sides in a Peet-Grady chamber kept at a temperature of 29±1°C [about 84°F.]. The tops of some of the cages were covered to keep out the naphthalene that settled out above them. The percentage mortalities in 24 hours of flies exposed in covered cages for 20 minutes from the time the naphthalene was introduced, introduced after 15 minutes and exposed for 35 minutes and introduced after 20 minutes and exposed for 30 minutes were 89·9, 10 and 1·8 when naphthalene was used alone and 98·6, 71 and 17·2 when it was used with smoke. In uncovered cages, the percentage mortalities of flies exposed for the first 20 minutes and the following 30 minutes were 99·8 and 3 for naphthalene alone and 99 and 24·4 for naphthalene with smoke. The lengthening of the effective period of dispersed naphthalene by vaporisation in the presence of smoke appeared to be due to adsorption of the insecticide on the inert particles, which changed the rate of crystallisation and the size of the crystal and caused the naphthalene to be deposited more uniformly on all surfaces, regardless of position, instead of chiefly on the floor.

ANDERSON (L. D.) & HOOK (R. A.). **Effects of Pyrethrins upon Blowflies.**—*J. econ. Ent.* **34** no. 5 pp. 725–726, 1 ref. Menasha, Wis., 1941.

As the cuticle of an insect is softer and thinner immediately after ecdysis or adult emergence than at other times and it might therefore be supposed that individuals that had just cast their skin or emerged would be more susceptible to the action of contact poisons than others, experiments were made on the relative susceptibility to pyrethrins of newly emerged and older individuals of *Phormia regina*, Mg. The insecticide used was an ester of mannitan and coconut oil fatty acids containing 1 per cent. pyrethrins, and the same product without pyrethrins was used as a control. The flies were dipped for 15 secs. in aqueous dilutions of the experimental materials, and mortality was estimated after 48 hours. The control material was toxic, but less so than the one containing pyrethrins, the mortality caused by both was related to concentration, and the material containing pyrethrins was less toxic to newly emerged flies than to those 3–12 or 36–48 hours old [*cf. R.A.E.*, B **26** 86]. The last finding was unexpected. The newly emerged flies may be more resistant than older ones

either because the pyrethrins do not penetrate the new cuticle so readily or because the nervous system has not reached its maximum susceptibility. They were dipped before their wings had expanded, and those that recovered from paralysis were not able to expand them afterwards, but were able to mate and lay fertile eggs. The material without pyrethrins was tested only on the older flies.

Gelormini (N.) & Roveda (R. J.). **Sarna epidermóptica en el canario.** [Epidermoptic Mange in the Canary.]—*Rev. Fac. Agron.* **9** pt. 2 pp. 143–146, 3 figs. Buenos Aires, 1941.

The type of mange caused in birds by *Epidermoptes bilobatus*, Rivolta, is rare, and some authors have attributed it to other mites observed in association with *Epidermoptes*. The authors found the latter alone on a canary and two other cage birds. It occurred in the external layers of the skin, especially at the base of the down feathers, and caused an intense pityriasis. It is readily controlled by a mixture of balsam of Peru and 70 per cent. alcohol, but a cheaper treatment consists in scraping off the crusts, wetting the affected areas with tepid soapy water, drying, and thoroughly rubbing in a mixture of 1 part kerosene and 10 parts vegetable oil, repeating the application after a week.

Papers noticed by Title only.

Steinhaus (E. A.). **A Study of the Bacteria associated with thirty Species of Insects** [in Ohio].—*J. Bact.* **42** no. 6 pp. 757–790, 17 refs. Baltimore, Md., 1941.

Coutinho (J. O.). **Observações sôbre algumas espécies de flebótomos com a descrição do macho de *Flebotomus lloydi* Antunes, 1937.** [Remarks on some Species of *Phlebotomus* with a Description of the Male of *P. lloydi*.]—*Arq. Zool. S. Paulo* **1** pp. 331–338, 2 pls., 3 figs., 14 refs. São Paulo, 1940. (With a Summary in English.) [Recd. 1942.]

Vargas (L.). **Notas sobre la importancia sanitaria de los simúlidos y de su morfología interna.** [Notes on the Importance of Simuliids in Relation to Disease and their internal Morphology (a review of the literature).]—*Rev. Inst. Salub. Enf. trop.* **2** no. 2 pp. 213–236, 10 pls., 26 refs. Mexico, D.F., 1941.

De Meillon (B.) & Rebêlo (A.). **Culicini (Diptera, Nematocera) from the Colony of Moçambique** [28 species, one new, with records of breeding places].—*Moçambique-Docum. trim.* no. 27 pp. 69–77. Lourenço Marques, 1941.

Lennox (F. G.). **Studies of the Physiology and Toxicology of Blowflies. 8. Rate of Ammonia Production by Larvae of *Lucilia cuprina* and its Distribution in this Insect.**—*Pamphl. Coun. sci. industr. Res. Aust.* no. 109 pp. 3, 7, 9–35, 9 figs., 23 refs., multigraph. Melbourne, 1941. **9. The Enzymes responsible for Ammonia Production by Larvae of *Lucilia cuprina*.**—*T. c.* pp. 4, 7–8, 37–64, 11 figs., 26 refs.

Cánepa (E.) & Da Graña (A.). **La presencia del *Demodex folliculorum* Owen en los ganglios linfáticos de perros demodécticos.** [The Presence of *D. folliculorum* in the lymphatic Glands of Dogs with demodectic Mange.]—*Rev. Fac. Agron.* **9** pt. 2 pp. 109–114, 5 figs. Buenos Aires, 1941.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

Sir Guy Marshall, K.C.M.G., F.R.S., D.Sc.
and
Dr. Sheffield A. Neave, C.M.G., O.B.E.

Sir Guy Marshall has been Director of the Imperial Institute (formerly Bureau) of Entomology, since it was founded in 1913. He is known personally or by repute to most entomologists in the world. A numerous and widely scattered circle of friends will regret his retirement on 31st July as deeply as do the Executive Council and the Staff of the Institute. He takes with him all their best wishes. His connections with the Institute are not, however, being severed entirely. For the time being he will continue his work on the identification of certain groups of insects and, at the invitation of the Secretary of State for the Colonies, his supervision of the work of the Anti-Locust Research Centre.

He is being succeeded as Director by Dr. S. A. Neave, C.M.G., O.B.E., who has been Assistant Director since 1914 and has been for many years in charge of the *Review of Applied Entomology*. Latterly he has completed and issued the *Nomenclator Zoologicus*—an indispensable book of reference. Many know him personally; many more know the publications for which he has been responsible.

Sir Guy was appointed Scientific Secretary to the Entomological Research Committee (Tropical Africa) on 1st July, 1909. At the same time Dr. S. A. Neave was appointed one of the two entomologists to work in Tropical Africa. "If we are to make our Central African colonies habitable and profitable and healthy, increased attention should be paid to the insect fauna, whether inimical or beneficial, but in the first instance to the former," expressed the purpose of the new Committee. The receipt of specimens sent in by the collectors, their identification, report back on them to the collectors, and the issue of a Bulletin that it was hoped might be published, were the chief duties of the Secretary. Applied Entomology was thus the objective; "the judicious encouragement and stimulation of the field workers by correspondence" and the dissemination of information were to be the means, not detailed direction and control of the work of the entomologists in the field.

This small organisation was soon extended. With the active support of Canada, it became in 1913 a truly inter-imperial service maintained by and serving all countries in the British Commonwealth. The *Review of Applied Entomology*, surveying regularly all current literature on Economic Entomology, was started. Sir Guy has been in charge throughout, and throughout the methods have remained the same—help, stimulation and dissemination of knowledge and information to the man in the field and to entomological departments; never control or dictation. The service has proved its worth; the bureaux which have come later follow those same principles, proved and tested by the Institute. The service Sir Guy built up has extended far beyond anything he imagined in 1909.

S. LALL,
Chairman,
Executive Council of the Imperial Agricultural Bureaux.

21st July, 1942.

(1425) Wt.P7/8717 1,400 8/42 S.E.R.Ltd. Gp. 432. [2] A

Ramakrishna Ayyar (T. V.). **Handbook of economic Entomology for South India.**—Roy. 8vo, xviii [1]+528 pp., col. frontis., 413 figs., 8 pp. refs. Madras, Govt. Pr., 1940. Price *Rs.* 5-8-0. [Recd. 1942.]

This work, which is noticed elsewhere [*R.A.E.*, A **30** 366], contains a section (pp. 405–415) on insects that attack cattle and other domestic animals in southern India, and another (pp. 425–439) on those that attack man or are concerned in the transmission of human disease.

Johnson (C. G.). **Insect Survival in Relation to the Rate of Water Loss.**—*Biol. Rev.* **17** no. 2 pp. 151–177, 12 figs., 24 refs. Cambridge, 1942.

The following is the author's summary. If the relation between rate of water loss from an insect and saturation deficiency is linear and survival is limited only by water loss, then the curve of longevity against saturation deficiency is hyperbola-shaped. The position of this curve with respect to the co-ordinates is, however, affected by other factors, which are discussed. The work of Bacot & Martin [*R.A.E.*, B **13** 128] on the longevity of the rat flea, *Xenopsylla cheopis*, Roths., is reviewed in the light of the above hypothesis: errors in curve fitting are revealed which make it necessary to modify some of Bacot & Martin's conclusions. Selected data from various authors subsequent to Bacot & Martin are considered. The discrepancies, real and apparent, between Leeson's results with rat fleas [B **20** 181; **24** 250] and those of Bacot & Martin are analysed, and it is pointed out that these were to some extent due to errors in curve fitting. The hypothetical relation between longevity, rate of water loss and saturation deficiency set out in the first part of this article is illustrated by Ludwig's data for *Popillia japonica*, Newm. [A **25** 520]; the linear relationship between 1/longevity and the rate of water loss demonstrates the hypothesis that water loss limits survival with this insect. Other less complete data are also discussed. Various types of longevity-saturation deficiency curves are described and the causes which probably account for such variations. The relationship of pupal or egg mortality to saturation deficiency cannot by itself throw light on the variation of rate of water loss with saturation deficiency; the time factor must also be taken into account. Lines of equal mortality may coincide with lines of equal saturation deficiency (the co-ordinates being relative humidity and temperature), so that the product of mortality and saturation deficiency is constant at any one temperature; but this indicates only that temperature is without effect on mortality and does not throw light on the relation of mortality to different saturation deficiencies. Such coincidence of lines cannot, therefore, be taken as proof that Dalton's law operates.

Pipkin (A. C.). **Filth Flies as Transmitters of** *Endamoeba histolytica*.—*Proc. Soc. exp. Biol.* **49** no. 1 pp. 46–48, 7 refs. New York, N.Y., 1942.

The literature on the possibility of flies being transmitters of amoebic dysentery [*cf. R.A.E.*, B **5** 117; **9** 126; **21** 35] is briefly reviewed, and details are given of experiments carried out with *Sarcophaga misera*, Wlk., *Phormia regina*, Mg., *Cochliomyia macellaria*, F., *Lucilia cuprina*, Wied. (*pallescens*, Shann.) and *Musca domestica*, L. Trophozoites and cysts of *Endamoeba histolytica* could be cultured from surface-contaminated flies for only 1·5 and 4 minutes after contamination, and it is concluded that these flies play no important part as transmitters by external carriage. When, however, the flies ingested them, trophozoites were culturable from the crop after periods of from 15 minutes, (*Musca* and *Lucilia*) to 40 minutes (*Sarcophaga*) and from the gut after 5 minutes (*Musca*, *Lucilia* and *Phormia*) and 30 minutes (*Sarcophaga*). Cysts were cultured from the digestive tract of each species of fly and after maximum periods of 210 and 180 minutes from the crop and rectum of *Sarcophaga* and

240 minutes from the gut of *Musca*. Culturable trophozoites and cysts were recovered from the vomitus after as long as 17 and 64 minutes of internal carriage in *Lucilia* and *Phormia*, respectively, and cysts from fecal droplets after 137 minutes in *Phormia* and 218 minutes in *Cochliomyia*. These results appear to indicate a potential natural method of transmission.

Brues (C. T.). **Insects as Carriers of Poliomyelitis Virus.**—*Science* **95** no. 2459 pp. 169–170, 7 refs. Lancaster, Pa., 1942.

Sabin (A. B.) & Ward (R.). **Insects and Epidemiology of Poliomyelitis.**—*T. c.* no. 2464 pp. 300–301, 7 refs.

In the first paper, the author draws attention to investigations by Sabin & Ward on the possible transmission of the virus of poliomyelitis [infantile paralysis] by insects [*R.A.E.*, B **30** 93] and criticises them for working with batches of unidentified flies. He considers it unlikely that blood-sucking flies were included in the batches as they are attracted almost exclusively to living animals and would probably not come to a trap unless it contained a living bait. He states that it is growing increasingly evident that poliomyelitis is not spread by direct contact or healthy carriers, inclines to the belief that insects are at least a major factor in its dissemination, and, in view of the epidemiological similarity between poliomyelitis and bubonic plague, suspects that rodents and fleas are concerned. It was discovered by Armstrong in 1939 that the cotton rat (*Sigmodon hispidus hispidus*) is susceptible to experimental infection.

In the second paper, Sabin & Ward state that the bait they used in Atlanta consisted of sliced banana sprinkled with sugar, and that the batch of flies from which the virus was isolated comprised 203 individuals of *Musca domestica*, L., and 5 blowflies, 3 of which were *Lucilia* (*Phaenicia*) *sericata*, Mg., whereas in Cleveland, fresh meat was added to the bananas and sugar, and 90–95 per cent. of the flies taken were Calliphorids, principally *L. sericata*, the remainder being Muscids, principally *M. domestica*. They disagree with Brues' view that the spread of the disease cannot be traced to direct or indirect contact, and state that in a Chicago suburb in the summer of 1941 there was a striking example of spread through carriers. They point out, moreover, that the disease is known to occur in the winter, and in answer to the suggestion that it is carried by fleas and that rodents are a reservoir, state that numerous strains of human or recent human origin have failed to become established in rodents. They believe that the search for a reservoir should continue, but emphasise the similarity of poliomyelitis to typhoid and dysentery in which the chief reservoir is human excreta and both direct spread and spread by insects are possible; they regard poliomyelitis as a disease occurring all the year round but having a greater incidence in summer and autumn because greater dissemination is possible partly through insects such as flies. Blood-sucking and biting insects should not be completely left out of consideration.

Jack (R. W.). **Further Studies in the Physiology and Behaviour of *Glossina morsitans*, Westw.**—*Mem. Dep. Agric. S. Rhod.* no. 3, [4]+56 pp., 6 charts, 7 refs. Salisbury, S. Rhod., 1941.

This paper comprises records collected on the eco-climate of various situations in the Chipane area of Southern Rhodesia in which *Glossina morsitans*, Westw., occurs and the results of observations on the bionomics of the fly in the field, made by W. L. Williams. The observations were planned as an extension of the author's laboratory research [*R.A.E.*, B **28** 22]. The eco-climatic records were collected from July to November 1938 in six situations, of which two were in evergreen river forest, two in savannah forest, one in open country at

an altitude of 3,000 ft. and one in open country at an altitude of 1,400 ft. in the Zambezi valley. The findings at this last-named station show that the evaporation rate is very high during the latter part of the dry season. There were nine days on which the temperature in the screen rose to 104°F. or over, whilst on four days it rose to 106°F. or over. It is considered evident that in many localities, cooler refuges than those afforded by simple shade must be essential for *G. morsitans* during the latter half of the dry season, and it is suspected that in exceptionally hot periods, the fly might suffer a severe setback. Records obtained at the other stations showed that flies in the shelter of certain kinds of riverine forest are exposed to a much lower evaporation rate than is apparent from standard meteorological records.

The following is based on the author's summary of data obtained in the course of the observations on bionomics. They showed a great variation in the weight of blood ingested at a meal by flies of the same sex, whether they were wild flies or unfed reared ones offered food on the day after emergence. There was also great variation of weight among flies caught at the same interval after feeding, and it is considered that the weight of a fly has relatively little value in indicating the period that has elapsed since its last meal. A meal caused a marked depression in the water ratio (percentage of water to wet weight less fat) on the day after feeding, followed by a rise and then a gradual decline if another meal was not obtained. The weight of fat in wild flies caught at the same interval after a meal was very variable. The percentage of wild flies recaptured after being fed and released was much higher in both sexes than the percentage of bred flies recaptured after being fed once on the day after emergence and then released. Flies taken on the higher veldt had, on an average, a higher water ratio than flies taken in the Zambezi Valley. The males caught in the valley had a lower mean fat content than those taken on the higher veldt, although the contact between game and fly is judged to have been greater in the valley. When young flies were excluded, the water ratio in females caught on moving man was lower than that in the males. Following a week of excessively hot, dry weather in the valley, flies of both sexes taken on cars and on man had a very low water ratio, and were very reluctant to leave the shade. Unfed flies with a low fat content (under 0·5 mg.) had a significantly lower average water ratio than unfed flies with a higher fat content, particularly at the higher altitude. Flies with a water ratio of 73 per cent. and over were shown to be either unfed flies not long emerged, flies that imbibed blood at the time of capture or flies with a considerable fat reserve. Fed males with a fat content of under 1 mg. had, on an average, significantly lower water ratios than those with a higher fat content. Individual analyses of old flies of both sexes caught on the higher veldt and having a water ratio of 67·2 per cent. or less and comparison with controls with a similar weight of non-fatty solids showed that the flies were definitely short of water, the fat content being also generally low, and it is concluded that flies do lose water in excess of replacement in the field. It is deduced that at the time of year concerned, flies maintain their water content by metabolism of fat as long as a considerable reserve of this remains, but that loss of water becomes more rapid than production as the fat reserve diminishes. Data on the accumulation of non-fatty solids are presented. The nature of these solids requires investigation. They outlast the fat during starvation. The results are also given of observations on the percentages of young males and young females to the total catch of the same sex on different attractants.

A table is given showing the weights of wild pupae collected weekly in the field, the percentage parasitised (average 4·1) and the percentage that produced adults (average 77). Whilst the lowest percentage of emergence (56) was obtained from pupae collected at the end of the hottest and driest week of the period, it is considered questionable whether this was due to the conditions to which the pupae had been exposed. Comparison between the weights of pupae

bred in the laboratory and of others collected in nature suggest that by proper feeding of the females at a suitable temperature (*e.g.* 24°C. [75·2°F.]), pupae can be obtained in the laboratory that are as heavy as the average wild ones. A correction to a previous paper, which has already been noticed [**28** 81], is appended.

GIBBINS (E. G.). **Studies on the Bionomics, Control and natural Infectivity of the Riverine *Glossina palpalis* Subspecies *fuscipes* Newstead in the West Nile District of Uganda.**—*Ann. trop. Med. Parasit.* **35** no. 2 pp. 195–217, 2 pls., 1 map, 2 figs., 5 graphs, 16 refs. Liverpool, 1941.

The recommendations on river clearings made as a result of a study on the bionomics of the tsetse responsible for the transmission of sleeping sickness in the West Nile district of Uganda, which was carried out between June and November 1938 and of which an account is given in this paper, have already been noticed [*R.A.E.*, B **28** 26]. The fly concerned is *Glossina palpalis*, R.-D., and all individuals found belonged to the subspecies *fuscipes*, Newst. [**25** 64], which appears to be the only form of the species in Uganda. Specimens collected from various regions including Lakes Albert, Edward and Victoria were identical. Sleeping sickness, which is known to have been present in the district since about 1904, remains endemic in the northern countries of Aringa [**27** 41], Omugo and Terego, where most of the studies were made, although it has been controlled in the rest of Uganda. Large and small rectangular block clearings, dumb-bell clearings, diamond-shaped clearings and rod-clearings [**26** 224] were in existence at the beginning of the experiment. As much money and labour must be expended and valuable timber sacrificed in making large clearings and as their maintenance involves great labour and recurrent expenditure, it was important to ascertain the minimum clearing adequate to reduce fly-density to a safe figure. The recorded densities were based on actual captures over a period of one full hour, and represented the average of the captures of not less than 10 boys. They were taken at weekly intervals.

G. p. fuscipes was found to occur only along watercourses. It was taken along all the streams and rivers visited, regardless of the distance from the mouth, but prolonged search was often necessary to establish its presence along the smaller streams. The natural riverine conditions are not particularly favourable to it. Breeding-places are scattered and mainly temporary, and frequent fluctuations in the water-levels, with periodical flooding of the most favourable breeding-grounds, restrict propagation. Activity was limited to the watercourses; a wide clearing serves no useful purpose as the fly is content to stay by the river, leaving it only when attracted by a host, and neither the width of the clearing nor the density of the forest belt deters it from following a man who has been to the river-bed. Experiments with marked flies showed that the range of flight along the watercourse, however, is considerable, both up and down stream; 4–5 miles were sometimes covered between 4 p.m. and 10 a.m. the following morning. A rod-clearing 800 yards long and 10 yards wide on either side of the river reduced fly-density to below 2 per boy-hour, whereas in a clearing 400 yards long, the density ranged up to 10·8 and was as high as in the control strip. Clearings as much as two miles long do not stop the passage of occasional flies, which are encouraged by the lack of cover to travel more quickly along the watercourse. Though flies are rarely found in the heavy shade of virgin forest, the densest parts do not deter them in their passage along the river.

Clearings in which tall grass had been allowed to grow were more favourable to fly than the untouched forest, but the presence of tall trees did not increase fly-density provided that they were well spaced, clean-boled and without low drooping branches. Shade from trees and river banks did not increase fly-density, but the proportion of males to females taken in clearings increased

with the amount of shade. Humidity was not the factor responsible for confining activity to the river [*cf.* **27** 41]. There was frequently no difference between the humidity at the river and in the bush beyond. No correlation was found between the number of flies caught in a particular place and the relative humidity at the time, but activity was greatly influenced by temperature, about 80°F. being the most favourable. The activities of the fly in the open are greatly hampered by dragonflies, many species of which are extremely common along the rivers and streams of the West Nile. The efficiency of well-kept rod-clearing is doubtless due more to the absence of protective cover than to the element of shade.

While the studies were being made, 215 cases of sleeping sickness occurred in the area, yet not a single infective fly was found among 2,122 specimens of *G. p. fuscipes* dissected or 823 used in feeding experiments with guineapigs. Of 246 gut dissections, 10 per cent. showed flagellates.

GORDON (R. M.) & SEATON (D. R.). **A histological Comparison of the Effects of certain Drugs on Scabies, as studied in Rodent Infections.**—*Ann. trop. Med. Parasit.* **35** no. 2 pp. 247–268, 3 col. pls., 3 figs., 43 refs. Liverpool, 1941.

The substances in popular use for the control of scabies (*Sarcoptes scabiei*, DeG.) contain sulphur (free or combined), rotenone or benzyl benzoate. Data on them are reviewed from the literature, which shows that all three are effective in curing a large proportion of cases when properly used and that dimethylthianthrene (mitigal) appears to be the best of the sulphur preparations. It is an oily compound containing about 25 per cent. organically combined sulphur. Elemental sulphur, which has been looked upon as a specific remedy, is effective, but is usually prescribed in the form of an ointment, which has to be applied on at least three successive days, is unpleasant to use and may cause dermatitis. The work here reported was designed to discover the most effective treatment and to compare with it a new substance, tetraethylthiuram monosulphide. Rotenone was discarded at an early stage because of the severe scrotal dermatitis that it occasionally provokes.

The experiments were carried out on Syrian hamsters (*Cricetus auratus*) and rats naturally infected with *Notoëdres* sp., which is similar to *Sarcoptes* in its life-history and response to treatment, and on a few artificially infested guineapigs. Preliminary washing and scrubbing of the infested areas opened the burrows, removed many of the mites and their eggs and increased the penetration of the drugs. Tetraethylthiuram monosulphide, dimethylthianthrene and benzyl benzoate, when mixed with an equal quantity of the methyl ester of the fatty acids of coconut oil, all penetrated the normal skin within 15 minutes, apparently by the hair-follicles and sebaceous glands. The results of investigations on the effect on the penetrative powers of the drugs of the addition of a surface active agent were inconclusive, but it decreased their lethal action. Four applications of dimethylthianthrene during a period of 10 days resulted in complete destruction of all the mites and their eggs. In a comparative study of this substance, benzyl benzoate and tetraethylthiuram monosulphide, each used with an equal part of the diluent and no surface active agent, the three substances massaged into the affected part for 3 minutes caused, respectively, 49, 67 and 76 per cent. degeneration of the mites and 25, 34 and 50 per cent. degeneration of the eggs after 24 hours. The corresponding figures after 3 days were 94, 100 and 100 and 50, 47 and 78. The findings justify the trial of tetraethylthiuram monosulphide in human scabies, but there is no evidence of the extent to which it may cause dermatitis. In view of the incomplete kill of eggs, two applications at an interval of at least four days are suggested.

The transmission of scabies by clothing and bedding is discussed [*cf. R.A.E.*, B **29** 182]. Experiments carried out on rats showed that mites, particularly

larvae, of the genus *Notoëdres* migrate freely from their burrows to fresh sites and may be transferred to surrounding material and thence to other animals.

GORDON (R. M.), DAVEY (T. H.) & PEREGRINE (E. P.). **A mechanical Trap for sampling Mosquito Populations entering Houses.**—*Ann. trop. Med. Parasit.* **35** no. 2 pp. 269–276, 3 figs., 19 refs. Liverpool, 1941.

In the continuously operating mosquito trap described in this paper, mosquitos trying to enter a hut by the window over which the trap is fitted alight on an endless screen of fine-mesh mosquito netting fitted taut on two rollers and moving at five feet per minute. They are carried upwards on the screen into a collecting box in which they are trapped by a series of eight vanes formed by four celluloid slides that intersect inside a revolving drum and slide in and out of it by the force of gravity. The drum revolves at a speed that allows the edge of the vane to travel upwards in contact with the screen and at the same rate. By the time one vane has completed its vertical path, the next is in position to shut off the succeeding length of netting with the mosquitos on it. The edge of the vane has become flush with the surface of the drum by the time that the latter passes against the side of the collecting box. The dimensions of the trap are given and also calculations enabling the correct proportions to be maintained between drum speed and screen speed in traps of different sizes. All other possible approaches to the hut must be sealed. The occupier acts as bait. No opportunity has so far arisen to test the trap under natural conditions in the tropics, but in the laboratory, mosquitos introduced into the trap while it was operating were retained in the collecting chamber without damage from the moving parts. It would probably be advisable to fit a wide-mesh wire-gauze screen in front of the moving netting to exclude large insects that might interfere with the mechanism.

KENNEDY (J. S.). **On Water-finding and Oviposition by captive Mosquitoes.**—*Bull. ent. Res.* **32** pt. 4 pp. 279–301, 4 figs., 17 refs. London, 1942.

The following is the author's summary of the results of a study of the behaviour of *Anopheles maculipennis atroparvus*, van Thiel, *Culex pipiens molestus*, Forsk., and *Aëdes aegypti*, L., before and during oviposition, in which direct observations were made of activity in a cage of white cotton in which one side was made of glass lined with mosquito netting, and water was provided in dishes in a hole in the floor. *Anopheles* and *Culex* when ready to lay make repeated descents to the ground and fly about with a skimming-hopping movement, while *Aëdes* flies about generally, at all heights. On encountering water *Anopheles* breaks into a hovering flight, laying its eggs during this "oviposition dance" [*cf. R.A.E.*, B **28** 231] or while settled on the water. *Culex* stops "dead" on the water and lays its eggs settled there, as does *Aëdes*, but with some fidgeting about. After encountering water mosquitos may leave it again, but fly about the floor more steadily and persistently than before. Among the factors which stimulate mosquitos after they have arrived directly over a water surface, contact with the surface is essential for actual oviposition by *Culex* and *Aëdes*, and almost so for *Anopheles*. Good pre-ovipository responses may be induced by water vapour alone and by the reflection from the surface, although how this latter stimulus acts is not clear. A dark appearance, especially if the surroundings are relatively light, facilitates these responses. Direct attraction of the mosquitos over the short range available in a cage was only induced by a contrastingly dark appearance, but *Anopheles* and *Culex* are aided in water finding by diurnal changes, correlated with light and activity changes, in the sense of their geotactic response.

Lewis (E. A.). **Notes on *Glossina longipennis* and its Breeding-places.**—*Bull. ent. Res.* **32** pt. 4 pp. 303–307, 2 pls., 4 refs. London, 1942.

In Kenya, *Glossina longipennis*, Corti, occurs chiefly in dry and unproductive country and has not so far affected agricultural development, but as it is known to occur also in fertile land in the Machakos district which it is hoped to develop shortly, observations were made in the Voi-Makindu fly-belt in March 1941 to obtain data on the habitats in which it lives and breeds. The region and its vegetation are described. The northern section is infested with *G. longipennis* and *G. pallidipes*, Aust., and to a smaller extent with *G. brevipalpis*, Newst. During the four days spent in the infested area, two adults of *G. longipennis* were collected during bright daylight, more were observed and captured in the early mornings and by far the largest numbers late in the evenings. The flies suddenly became active as the sun disappeared over the horizon. They were apparently not attracted to stationary lights. All the individuals taken were males. Large numbers were caught within 200 yards of a flowing river [*cf. R.A.E.*, B **10** 11] and others over a stretch of road 2,000 yards long between this river and a seasonal one that contained no water. Two were caught at night in the dry savannah about five miles below the flowing river. Not a single individual was obtained from the thickets, though most of the flies seemed to come out of this type of bush. At the conclusion of the experiment, three fly-boys travelling by train from a point about 18 miles from the fly-belt to Nairobi noticed 20 flies in their compartment, of which they were able to collect 8. Lorries and cars, especially those passing through the Voi-Makindu fly-belt at night, probably also carry *G. longipennis* to localities outside the infested areas.

The sites that seemed to be most favoured for larviposition were under logs, leaning tree-trunks and the stumps of felled trees near shrubby or woody thickets. Breeding-places were also found in open country many hundreds of yards from dense bush, and in the shade of single trees in the savannah. The thick bush on the banks of the rivers did not appear to provide suitable conditions for larviposition. The puparium is described.

Nash (T. A. M.). **A Study of the Causes leading to the seasonal Evacuation of a Tsetse Breeding-ground.**—*Bull. ent. Res.* **32** pt. 4 pp. 327–339, 1 pl., 9 refs. London, 1942.

The following is based on the author's summary. A study carried out at one of the tsetse breeding-grounds in Northern Nigeria described in a paper already noticed [*R.A.E.*, B **27** 261] showed that breeding of *Glossina morsitans* [race *submorsitans*, Newst.] and *G. tachinoides*, Westw., shifts annually in March from the edge of a residual forest island to the centre, a distance of some 40 yards. The move is associated with an increase in mortality amongst the last pupae at the forest edge [*cf.* **27** 201] particularly those of *G. tachinoides*, death usually occurring late in pupal life. The object of this investigation was to discover what prompts the female to move just before pupal mortality increases. It was found that there was little difference in the temperature conditions of the two breeding-grounds, but that the evaporation rate was one-third less in the centre of the forest. However, the abandonment of the forest margin is not explained by attributing to the female the ability to detect differences in the evaporative power of the air, but rather by the negative reaction to light developed by the whole community under conditions of universally high temperature. The period of migration coincides with an abrupt increase in the number of hours when the shade temperature is above 90°F., approximately the point at which the negative reaction to light begins [*cf.* **26** 29]. During March, the temperature is below this figure by day only immediately after dawn when larviposition rarely occurs under laboratory conditions [**21** 201], and remains above it until well after activity has ceased

at dusk, so it is probable that flies that are not hungry spend most of the day and all the night in the centre of the forest. Field observations suggest that in the evenings the stimulus of hunger may overcome the negative reaction to light, as then flies will undoubtedly attack in the forest edge, but since pregnant females rarely feed for several days before larviposition, this counter-stimulus is unlikely to be operative at the time that it occurs. By moving into the centre of the forest, the flies gain a reduction in temperature of only 3 or 4°F., but they are less susceptible to heat, as the much lower evaporation rate reduces their water loss.

As the microclimate in the pupal environment at the forest edge at a depth of 1½ inches was found to favour survival, it was concluded that the factor that inhibited emergence must have been operative before the puparia were formed. Possibly high surface evaporation and unsaturated soil atmosphere affect the formation of the pupal integument at the time of pupation, rendering subsequent emergence impossible. The meteorological data collected are more detailed and localised than any yet published by the author, and they should give a better picture of the dry season, adult and pupal environments in a locality that is very close to the hot, dry limits of the range of both species. Puparia were found in large numbers in soils of which the mean monthly temperatures ranged from 69 to 82°F. Field observations suggested that a constant temperature of 72°F. with a relative humidity of 80 per cent. or a temperature of 77°F. with a relative humidity of 100 per cent. are conditions that should provide very healthy puparia in the laboratory.

RUSSELL (P. F.) & RAMACHANDRA RAO (T.). **On the Ecology of Larvae of *Anopheles culicifacies* Giles, in Borrow-pits.**—*Bull. ent. Res.* **32** pt. 4 pp. 341–361, 1 pl., 6 figs., 5 refs. London, 1942.

It has been shown in earlier reports of work on the transmission of malaria in the Pattukkottai Taluk in Madras [*cf. R.A.E.*, B **27** 44] that *Anopheles culicifacies*, Giles, is the chief vector, that borrow-pits filled with irrigation water by seepage are a prolific source of this species, and that although larvae can be found throughout the year, the curves of incidence and density rise rapidly from the onset of the irrigation season in the middle of June until August or September and then decline in October and November, reaching moderate levels in December and January and very low ones from February to June when no irrigation water enters the area. This paper deals with an investigation of the factors that bring about the marked decline in intensity of breeding from September to January. Most of the studies were made in pits dug for experimental use, and in all cases they were filled by irrigation water seeping in from neighbouring canals. Collections from one pit in 1938–39 bore out previous findings, but when collections were made later in 1939 from two pits, one of which was dug on 30th July and the other on 19th September, it was found that whereas the usual decline had become well marked by early September in the first pit, the second was attractive when it filled with water, and the decline began in October. A series of borrow-pits was therefore dug, two about the 20th of each month from May 1940 to January 1941, inclusive. Regardless of season, the highest number of larvae of *A. culicifacies* was found in each pit when it was new, and at any given time larval density was greatest in the newest pits, but although the highest numbers were always found in the newest pits, the level of these highest numbers declined markedly from October onwards. Apparently the decline in larval density in a pit was due mainly to internal factors. The only evidence of influence by external factors was the general decline from October to January when climatic conditions seemed to play a part. Counts of eggs laid from February 1940 to January 1941 by females caught in nature gave no evidence of fluctuating seasonal fecundity.

The greater part of the paper consists of an account of observations on variation in the physical, chemical and biological characters of the borrow-pits in relation to breeding of *A. culicifacies*. Rainfall, predators, macroscopic vegetation, hydrogen-ion concentration, carbon dioxide, dissolved oxygen, bicarbonate alkalinity, ratio of free to bound and half bound carbon dioxide, hardness, chlorine, ammoniacal nitrogen, nitrates, nitrites, sulphates, phosphates, iron and poisonous metals appeared to have no effect. Albuminoid nitrogen and oxygen absorbed seemed to have some significance, which was not clear. Among plankton organisms, green algae, diatoms, rotifers and copepods showed no relation to breeding, protozoa as a group appeared to be negatively associated to a slight degree, and blue-green algae rather more definitely so. Amorphous organic matter, however, and more especially total plankton, showed statistically significant negative association with larval density, but the exact manner in which total organic matter acted as an inhibitory influence against breeding was not determined.

Tweedie (D. R.), Reid (J. A.) & Hodgkin (E. P.). **Fascine Drainage.**—14 pp. multigraph, 2 figs., 7 refs. [Kuala Lumpur] Malar. adv. Bd., F.M.S. [1941.]

This pamphlet was prepared to provide a brief explanation of the technique of fascine drainage as an anti-malarial measure [*R.A.E.*, B **29** 36] by the method that has been most used and has given satisfactory results in the small watercourses that are the most important breeding places of *Anopheles maculatus*, Theo., in Malaya. Fascine drainage is particularly useful when extensive replanting of rubber is in progress, as this increases the danger of malaria [*cf.* **28** 63, etc.], often necessitating the extension of control of mosquito larvae, and at the same time the felling that precedes replanting provides the materials necessary for the drains. The maintenance, durability, cost and uses of the drains are briefly discussed.

Venhuis (W. G.). *Anopheles aconitus* **aan kaliwanden.** [*A. aconitus* on the Banks of Streams.]—*Geneesk. Tijdschr. Ned.-Ind.* **82** pt. 3 pp. 99–112, 1 pl., 15 refs. Batavia, 1942. (With a Summary in English.)

Records are given showing that females of *Anopheles aconitus*, Dön., occur in larger numbers and with a high rate of malaria infection on the banks of small streams in East Java than they do at the same period in houses and stables. In investigations at Malang in April 1941, where an increase in the number of malaria cases was in progress, 210 males and 966 females were caught at a stream and 13 of the 884 females that were dissected contained malaria parasites, seven containing sporozoites. At the same time, only 118 adults were taken in houses and 128 in stables, 101 and 97 of these being females. Only four were infected ; these were taken in a house where there were three gametocyte carriers and contained oöcysts that were so slightly developed as to make it almost certain that the infection had been acquired on the evening that they were caught.

At Poegeran, none of 170 and 274 females taken from houses and stables, respectively, was infected, while of the 405 caught on the banks of streams, 394 were dissected and five contained oöcysts. At Lodjisanggar, one of 24 females taken at a spring contained oöcysts, while none of the 96 taken in houses and stables was infected. Experience has shown that the adults are abundant on stream banks if these places are moist, dark and quiet and the neighbouring houses and stables are not. It is possible that in the dry season, when houses and stables are less suitable shelters, the numbers of Anophelines on stream banks may be proportionately larger than in the rainy season.

In all, adults of 11 species of *Anopheles* have been found on stream banks in East Java, the most numerous, in order of decreasing abundance, being *A. aconitus*, *A. vagus*, Dön., *A. tessellatus*, Theo., *A. minimus* var. *flavirostris*, Ludl., *A. kochi*, Dön., and *A. maculatus*, Theo. [*cf. R.A.E.*, B **30** 18]. Two females of *A. leucosphyrus*, Dön., were also taken at a stream, though no adults or larvae of this species had previously been recorded in the locality.

The literature on the natural shelters of Anophelines is briefly reviewed, and it is emphasised that a survey for malaria vectors should include catches at such sites as well as in houses and stables.

VENHUIS (W. G.). **Geïnfecteerde** *Anopheles minimus* **var.** *flavirostris* **aan kaliwanden.** [Infected *A. minimus* var. *flavirostris* on the Banks of Streams.]—*Geneesk. Tijdschr. Ned.-Ind.* **82** pt. 5 pp. 190–194, 1 ref. Batavia, 1942. (With a Summary in English.)

The author has repeatedly found larvae of *Anopheles minimus* var. *flavirostris*, Ludl., to be abundant in the Netherlands Indies, while adults were very rare in houses and stables. Thus, in a rice-field area in Bali where 121 larvae were collected, not a single adult was found in houses and stables, and in a hill district 71 larvae were collected and only one adult. In East Java, 94 larvae were collected at Kepoeng in April 1939 and only 26 adults in houses and stables. This Anopheline has hitherto been considered to have little contact with man in East Java, though slightly more with cattle, and to be mainly a "wild" species. In February 1941, the author found numerous adults on the banks of streams in localities where larvae were also abundant. At the close of a malaria epidemic, due probably to *A. aconitus*, Dön., in a rice-field area, females of *A. m. flavirostris* taken on stream banks were dissected, and oöcysts were found in three out of 235. No sporozoites were found in 258 dissected for them. Oöcysts were subsequently found in two further females of this Anopheline in East Java, one from a stream bank and one from a house, whereas of females taken in buildings during 1937–40 only one of 511 examined for oöcysts and none of 673 examined for sporozoites was infected.

TEESDALE (C.). **Pineapple and Banana Plants as Sources of** *Aëdes* **Mosquitoes.**—*E. Afr. med. J.* **18** no. 9 pp. 260–267. Nairobi, 1941.

An account is given of observations carried out between 1st May and 19th June 1941 on the occurrence of mosquito larvae in water held by pineapple and banana plants in Mombasa [*cf. R.A.E.*, B **28** 115] and their ability to complete development in it. The following is based on the author's conclusions. The species most commonly found was *Aëdes simpsoni*, Theo., but *A. aegypti*, L., *A. metallicus*, Edw., and *A. pembaensis*, Theo., were also recorded, the last two from bananas only. Adults of all species emerged, but larval development was very considerably protracted on some occasions, and some larvae and pupae died although water was present. An adult of *A. simpsoni* emerged from a banana plant at the height of the dry season. This might possibly explain to some extent a carry-over of adults between the rains. Banana plants hold water throughout the year, but pineapples probably do not.

WOODHILL (A. R.). **The Oviposition Responses of three Species of Mosquitoes (*Aëdes* (*Stegomyia*) *aegypti* Linnaeus, *Culex* (*Culex*) *fatigans* Wiedemann, *Aëdes* (*Pseudoskusea*) *concolor* Taylor), in Relation to the Salinity of the Water.**—*Proc. Linn. Soc. N.S.W.* **66** pt. 5–6 pp. 287–292, 2 figs., 5 refs. Sydney, 1941.

An account is given of experiments designed to test the oviposition responses of *Aëdes aegypti*, L., *Culex fatigans*, Wied., and *A. concolor*, Taylor, in relation

to the salinity of the water. The first two are fresh-water species [*R.A.E.*, B **21** 74 ; **27** 37] and the third a salt-water species [**25** 93–94]. Several hundred adults were placed in cages, given blood meals and raisins and provided with two dishes for oviposition, one containing distilled water and the other saline water prepared by diluting or adding salts to sea-water of known composition. The positions of the two dishes were reversed each night. The room in which the cage was kept was darkened at night, and the temperature was maintained at 80°F. and the relative humidity between 70 and 75 per cent. The results are analysed statistically. They showed that *C. fatigans* is repelled by water containing 5 parts salts per thousand by weight and will not oviposit on water containing 10 parts if fresh water is available. *A. aegypti* distinguished water containing 5, 10, 17·5 and 35 parts salts per thousand from fresh water ; the percentage of eggs laid on saline water decreased as the proportion of salts increased, and no eggs were laid on water containing 35 parts salts per thousand. *A. concolor* did not distinguish between fresh water and water containing 5 parts salts per thousand, 50 per cent. of the eggs being laid in each dish, but it distinguished higher proportions of salts and laid an increasing percentage of its eggs on fresh water as the proportion of salts in the saline water increased, a very small percentage being laid in water containing 35 parts salts per thousand.

Woodhill (A. R.). **The Development of *Aëdes* (*Pseudoskusea*) *concolor* Taylor in Relation to small Quantities of Salts in Solution and to the Temperature of the Water.**—*Proc. Linn. Soc. N.S.W.* **66** pt. 5–6 pp. 396–400, 3 refs. Sydney, 1941.

The following is substantially the author's summary of this account of experiments on the effect of minute quantities of salts in solution on the development of *Aëdes concolor*, Taylor. *A. concolor* cannot develop in distilled water plus food. Normal development from egg to adult takes place if sodium chloride is added to the distilled water at the rate of 0·1 or 0·05 part per thousand by weight. No very significant increase in the percentage of adults emerging is obtained by substituting a mixture of sodium chloride and calcium chloride in the proportion of 95 : 5 for the pure sodium chloride. A high mortality occurs during the fourth instar when only 0·025 part sodium chloride per thousand is added. No development takes place when either potassium chloride, calcium chloride, magnesium chloride, sodium sulphate, magnesium sulphate or sodium nitrate is added to distilled water at the rate of 0·1 part per thousand. *A. concolor* can develop normally from egg to adult in tap-water (containing 0·06 part salts per thousand) or sea-water (35 parts) at a constant temperature of 70°F. or in sea-water (35 and 70 parts) at 80°F., but a very high mortality occurs in tap-water at a constant temperature of 80°F.

Richards jr. (A. G.). **Differentiation between Toxic and Suffocating Effects of Petroleum Oils on Larvae of the House Mosquito (*Culex pipiens* L.) (Diptera).**—*Trans. Amer. ent. Soc.* **67** no. 3 pp. 161–193, 4 pls., 4 pp. refs. Philadelphia, Pa., 1941.

Evidence has accumulated to show that the more volatile petroleum oils have a directly toxic effect on insects, and it has been presumed that since the non-volatile oils kill very slowly and are generally classed as non-toxic, their effect must be due to asphyxiation only. The literature does not show whether or not asphyxiation is an added factor in death due to toxic oils. An account is given of experiments carried out with larvae of *Culex pipiens*, L., which showed that suffocation and oil-toxicity produce different histo-pathological pictures in the central nervous system, both of which may be observed in

lethargic larvae capable of recovery, and that all oils, whether volatile or non-volatile, as usually applied in mosquito control, lead to histologically demonstrable effects of suffocation. With extremely toxic oils, this does not materially alter the time needed to kill. With less toxic oils, the results are rather variable, but a mean acceleration of killing time is imposed when asphyxiation is also a factor. Larvae submerged in water of low oxygen content die in about 70 minutes, but in aerated water, cutaneous respiration can sustain life for considerable periods. Immersion of larvae in aerated paraffin oil, a non-volatile oil, did not prevent them from respiring if the cuticle was dried before immersion, but death followed promptly when the cuticle was wet. It is concluded that air-dried larvae immersed in aerated paraffin oil probably do not die from asphyxiation and that adequate cutaneous respiration depends on direct contact between the oil and the cuticle. A summary and discussion are given of the literature on the suffocation of mosquito larvae and a discussion of cutaneous respiration in insects with particular reference to such respiration in water and in oil.

HESS (A. D.) & TARZWELL (C. M.). **The Feeding Habits of** *Gambusia affinis affinis*, **with special Reference to the Malaria Mosquito,** *Anopheles quadrimaculatus*.—*Amer. J. Hyg.* **35** no. 1 pp. 142–151, 2 figs., 2 graphs, 5 refs. Lancaster, Pa., 1942.

As the effectiveness of a predator in reducing the numbers of a species of prey depends mainly on its biotic potential and the preference that it shows for the prey, and the rapidity with which *Gambusia affinis* has become abundant in the newly impounded waters of the Tennessee Valley indicates a satisfactory biotic potential, studies were carried out from 12th June to 20th September 1940 to determine whether it showed a preference for *Anopheles*.

The following is based on the authors' summary of them. Three different ecological situations in Wheeler Reservoir, Alabama, were included in the investigations, and they involved the collection and examination of 295 sq.-ft. samples of surface organisms and the stomach contents of 1,018 *Gambusia*. The forage ratio, obtained by dividing the percentage of a given organism in the stomachs by the percentage of it in the environment, was used as a criterion of feeding preference. The data obtained indicate that the size of the forage ratio for any particular organism is affected by the species composition of the population of food organisms, the relative and absolute densities of the organisms and their stage of development. Probably other factors, such as the amount of protection available for the prey, are also important. The size of the forage ratio for both Anophelines and Culicines was directly correlated with their population densities, but when they were present in equal numbers, the greater preference was shown for Culicines. As mosquito densities increased, the number of fish eating them and the number eaten per fish also increased. The forage ratio for *Anopheles* was 1 when the larval density was about 2 per sq. ft. of water surface ; below this point it decreased and above it increased, reaching over 14 when the larval density was 17 per sq. ft. Male *Gambusia* ate only about half as much food as females of the same size groups, but it was of similar species composition. The amount of food eaten by females increased with their size, and the food of the largest fish contained a higher percentage of macroscopic organisms. *Anopheles* made up a similar percentage of the macroscopic food of all the fish, but they made up a higher percentage of the total food of larger ones, because the latter ate less plankton. In the case of all Diptera, *Gambusia* showed a much greater preference for pupae than for larvae, and for the later larval instars than for the early ones. In general, the studies indicated that availability is more important than choice in determining the extent to which a particular kind of organism will be taken as food by *Gambusia*.

Carpenter (S. J.). **The Mosquitoes of Arkansas.**—Revd. edn., 8vo, 72 pp., 15 pls., 60 refs. Little Rock, Ark., Ark. State Bd. Hlth., 1941.

This publication is a revision of one already noticed [*R.A.E.*, B **28** 43] and gives the results of work carried out over almost four years (1937–40) during which time collections were made in approximately four-fifths of the counties of Arkansas and 37 of the 42 species that are known to occur there were taken. The section on control measures is slightly extended, and the description of the experiment on the flight range of *Anopheles quadrimaculatus*, Say, is omitted.

Dampf (A.). **Los hipopigios masculinos de** *Anopheles hectoris* **y** *Anopheles parapunctipennis*. **(Insecta, Diptera, Culicidae.)**—*An. Esc. nac. Cienc. biol.* **1** no. 2 pp. 279–286, 3 pls., 10 refs. Mexico, D.F., 1939. (With Summaries in English and German.) [Recd. 1942.]

The author describes and figures the male hypopygia of *Anopheles parapunctipennis*, Martini, from the State of Chiapas, Mexico, and *A. hectoris*, Giaquinto, from Chiapas and Guatemala and gives characters distinguishing the latter from *A. pseudopunctipennis*, Theo. He considers that *A. chiriquiensis*, Komp [*R.A.E.*, B **25** 73] is a synonym of *A. parapunctipennis* [*cf.* **30** 12], since the male hypopygium as described by Komp differs only very slightly from that of *A. parapunctipennis*. The latter is a mountain species that occurs between 5,000 and 10,500 ft. in Central America, and is of no importance as a vector of malaria. *A. hectoris* appears to have adapted itself to both cold and hot climates. In Guatemala, where it is stated to be an important vector, it has been taken at 10,500 ft., and in Chiapas at 1,100.

Correa (M. L.). **La quetotaxia de la larva de** *Anopheles occidentalis* **Dyar & Knab. Un estudio bioestadistico.** [The Chaetotaxy of the Larva of *A. occidentalis*. A bio-statistical Study.]—*An. Esc. nac. Cienc. biol.* **2** no. 2–3 pp. 217–229, 5 pls., 12 refs. Mexico, D.F., 1941. (With Summaries in English and German.)

The author records the results of a study of the chaetotaxy of Anopheline larvae of the complex of *Anopheles maculipennis*, Mg., collected near Mexico City. She uses the name *A. occidentalis*, D. & K., for them, since she regards all the American representatives of the complex as belonging to a single species distinct from *A. maculipennis*, though the Mexican form has been considered by Vargas to represent another distinct species, for which he used the name *aztecus*, Hffm. [*R.A.E.*, B **28** 46]. She concludes that the chaetotaxy is very variable, and that sufficient material is not available for a comparative study of the forms of the *maculipennis* complex in America.

Zumpt (F.). **Die Rassenfrage bei** *Anopheles maculipennis* **Meigen. 1. Beitrag zum Problem der Artbildung und Artbegrenzung.** [The Question of Races in *A. maculipennis*. First Contribution to the Problem of Formation and Limitation of Species.]—*Z. Parasitenk.* **12** pt. 3 pp. 372–387, many refs. Berlin, 1941.

The author discusses the systematic status of the European Anophelines of the group of *Anopheles maculipennis*, Mg. At least seven of these have been distinguished, but it is not yet agreed whether they should be regarded as distinct species or as varieties or biotypes. They are *maculipennis* sens. strict. (*typicus*), *atroparvus*, van Thiel, *labranchiae*, Flni., *messeae*, Flni., *melanoon*,

Hackett, *subalpinus*, Hackett & Lewis, and *sacharovi*, Favr. Still other forms occur outside Europe. Apart from *sacharovi*, which differs in the adult, these forms can be distinguished from one another only in the egg-stage, and an unpublished table by F. Weyer is given showing the distinguishing characters. Their geographical distribution is discussed from the literature, with special reference to those that occur in Germany [*cf. R.A.E.*, B **27** 78], and the results of experiments on cross-breeding are reviewed [*cf.* **22** 137 ; **27** 158, etc.]. The author then summarises the main conclusions of Dobzhansky (1939) as to the factors leading to the differentiation of species. The external factors are geographical, ecological or temporal isolation of originally homogeneous groups, and the internal ones, which result from the former and may persist after their disappearance, are physiological modifications that hinder or prevent interbreeding between the individuals of different groups or render the offspring infertile. The forms of the *maculipennis* group, though only slightly differing from one another in morphology, have reached the stage of physiological differentiation, but instinctive isolation (lack of a mutual inclination to pair) plays a great part in this, since the production of fertile offspring by interbreeding is not yet excluded and doubtless occurs to some extent in nature. In view of the evident restrictions on interbreeding, however, the author considers that they should all be accorded specific rank and that in cases of doubtful identity a specimen should be recorded merely as belonging to the *maculipennis* group.

Hase (A.). **Weitere Beobachtungen über die Maskierung bei parasitären Wanzen (Cimicidae und Triatomidae).** [Further Observations on Masking in parasitic Bugs.]—*Z. Parasitenk.* **12** pt. 3 pp. 388–403, 18 figs., refs. Berlin, 1941.

The author records observations on the way in which some blood-sucking Rhynchota cover themselves with débris so as to resemble their environment. The species concerned were the Triatomids, *Triatoma dimidiata*, Latr. [*cf. R.A.E.*, B **29** 49], *T. flavida*, Neiva, *T. rubrofasciata*, DeG., and *Rhodnius prolixus*, Stål, and the Cimicids, *Oeciacus hirundinis*, Jenyns, *Cimex pipistrelli*, Jenyns, *C. hemiptera*, F. (*rotundatus*, Sign.) and *C. lectularius*, L. The Cimicids disguise not only themselves but also their eggs in this way. The nymphs of the Triatomids cover themselves much more than the adults, but the eggs are not covered. The origin and significance of the habit is discussed.

Osorno-Mesa (E.). **Las garrapatas de la República de Colombia.** [The Ticks of the Republic of Colombia.]—*Rev. Acad. colomb. Cienc.* **4** no. 13 pp. 6–24, 1 map, 2 figs. Bogotá, 1940. [Recd. 1942.]

In this paper, which is based on the literature and collections, the author gives a brief account of the morphology of ticks and keys to the families, genera and species that occur in Colombia, Panama and in some cases neighbouring regions. Records of the various species are listed, and the synonymy and identity of some of them are discussed. *Argas reflexus*, F., for which the author considers *A. columbarum*, Shaw (*Acarus columbarum*, Shaw, 1793, in Shaw and Nodder, Vivarium Naturae or the Naturalist Miscellany, IV, Pl. CXXVIII) to be an earlier name, is recorded from fowls in Colombia. *Ornithodoros venezuelensis*, Brumpt, is a synonym of *O. rudis*, Karsch, since Colombian examples of the former were found by Schulze to be indistinguishable from the type specimens of the latter. The author considers that *Anacentor colombianus*, Schulze [*R.A.E.*, B **25** 291] is a synonym of *Dermacentor nitens*, Neum., and also that it is doubtful whether this tick [for which the genus *Otocentor* was erected in 1938 (**27** 224)] is generically, or even subgenerically, distinct from *Dermacentor*.

PAPERS NOTICED BY TITLE ONLY.

PEREIRA BARRETTO (M.). **Morfologia dos ovos, das larvas e das pupas do** *Phlebotomus intermedius* **Lutz e Neiva, 1912 (Diptera, Psychodidae).** [Morphology of the Eggs, Larvae and Pupae of *P. intermedius*.]—*An. Fac. Med. Univ. S. Paulo* **16** pt. 1 pp. 91–105, 11 pls. (6 fldg.), 19 refs. São Paulo, 1940. (With a Summary in English.)

COUTINHO (J. O.) & PEREIRA BARRETTO (M.). **Contribuição ao conhecimento dos flebótomus de São Paulo.** [Contribution to the Knowledge of the *Phlebotomus* of São Paulo.] *Phlebotomus fischeri* **Pinto, 1926 e** *Phlebotomus pessoai* **n. sp. (Psychodidae).**—*Rev. Biol. Hyg.* **10** no. 2 pp. 89–103. São Paulo, 1940. PEREIRA BARRETTO (M.) & COUTINHO (J. O.). **II. Descrição do macho de** *Phlebotomus limai* **Fonseca, 1935 e de duas novas especies :** *Phlebotomus ayrozai* **e** *P. amarali* **(Diptera, Psychodidae).** [Description of the Male of *P. limai* and of two new Species, *P. ayrozai* and *P. amarali*.]—*An. Fac. Med. Univ. S. Paulo* **16** pt. 1 pp. 127–139, 1 pl., 14 figs., 6 refs. São Paulo, 1940. (With a Summary in English.) COUTINHO (J. O.) & PEREIRA BARRETTO (M.). **III. Descrição do macho de** *Phlebotomus alphabeticus* **Fonseca, 1936 e de** *Phlebotomus pascalei* **n. sp. (Diptera, Psychodidae).** [Description of the Male of *P. alphabeticus* and of *P. pascalei*, sp. n.]—*T.c.* pp. 193–206, 3 pls., 8 refs. (With a Summary in English.)

PESSÔA (S. B.) & PESTANA (B. R.). **Infecção natural do** *Phlebotomus migonei* **por formas em leptomonas, provavelmente da** *Leishmania brasiliensis*. [Natural Infection of *P. migonei*, Coutinho & Barretto, by leptomonad Forms, probably of *L. brasiliensis*.]—*Acta med.* **5** no. 2 p. 106. 1940.

PESSÔA (S. B.) & COUTINHO (J. O.). **Infecção natural do** *Phlebotomus pessoai* **por formas de leptomonas, possivelmente de** *Leishmania brasiliensis*. [Natural Infection of *P. pessoai*, Coutinho & Barretto, by leptomonad Forms, possibly of *L. brasiliensis*.]—*Rev. Biol. Hyg.* **10** pp. 139–142. São Paulo, 1940.

COUTINHO (J. O.). **Localisação de formas em leptomonas, possivelmente de** *Leishmania brasiliensis*, **no faringe do** *Phlebotomus pessoai* **naturalmente infestado.** [The Localisation of leptomonad Forms, possibly of *L. brasiliensis*, in the Pharynx of naturally infected *P. pessoai*, Coutinho & Barretto.]—*An. Fac. Med. Univ. S. Paulo* **16** pt. 1 pp. 163–171, 2 pls. (1 col.), 3 refs. São Paulo, 1940. (With a Summary in English.)

GREGSON (J. D.). **Two new Species of Ticks** [*Ixodes* on rodents] **from British Colombia (Ixodidae).**—*Canad. Ent.* **73** no. 12 pp. 220–228, 2 pls., 2 maps, 4 refs. Guelph, Ont., 1941.

ESKEY (C. R.) & HAAS (V. H.). **Plague** [in rodents and fleas] **in the western Part of the United States.**—*Publ. Hlth. Bull.* no. 254, 83 pp., 31 pls., 4 maps, 15 refs. Washington, D.C., 1940. [Recd. 1942.] [For abstract see *R.A.E.*, B **28** 26.]

SICART (M.). **Contribution à l'étude des anophèles de Tunisie. Présence de** *Anopheles* (*A.*) *claviger* **(Meigen 1884).**—*Arch. Inst. Pasteur Tunis* **30** no. 3–4 pp. 287–290, 1 fig., 8 refs. Tunis, 1941.

WIGGLESWORTH (V. B.). **The Storage of Protein, Fat, Glycogen and Uric Acid in the Fat Body and other Tissues of Mosquito Larvae.**—*J. exp. Biol.* **19** no. 1 pp. 56–77, 11 figs., 55 refs. London, 1942.

Yao (Y. T.) & Wu (C. C.). **The Finding of *Phlebotomus chinensis* Newstead from Yunnan and its Bearing on the Transmission of Kala-azar in South China with Remarks on the Success in infecting Chinese Hamsters with Flagellates from naturally infected *P. chinensis* found in Tsingkiangpu.**—*Chin. med. J.* **60** no. 3 pp. 232–240, 24 refs. Peiping, 1941.

As there is strong evidence that *Phlebotomus chinensis*, Newst., is the chief vector of both human visceral and canine general leishmaniasis in North China [*R.A.E.*, B **28** 34, 35, 69–70; **29** 35; **30** 16], its distribution there is reviewed from the literature and shown to coincide with that of the disease in man. It prevails in the endemic area and can be found in large numbers in infected houses within the area during the season of abundance. Records of its natural and experimental infection with *Leishmania donovani* are cited from the literature. Data on *P. sergenti* var. *mongolensis*, Sinton, which was less frequently found infected in nature and more difficult to infect experimentally, are included for comparison. The identity of flagellates obtained from ten infected individuals of *P. chinensis* found in a village of northern Kiangsu [**26** 60] was established by mixing the flagellates from six of the sandflies with 0·6 per cent. saline and injecting them into the peritoneal cavity of 11 striped hamsters [*Cricetulus griseus*], four of which developed kala-azar. Cases of kala-azar have occurred south of the Yangtze River, but it is not known whether the disease is endemic there. However, in view of the data summarised in the first part of the paper, the possibility of its existence in any place where sandflies, particularly *P. chinensis*, exist seems to be very great. *P. chinensis* has been found in Yunnan [**30** 80], and kala-azar has been found among persons who had not left Kwangsi Province or been associated with people coming from known endemic areas, as well as among others in Canton who had never left Kwangtung Province but who apparently obtained the infection from soldiers coming from northern China. It is concluded that kala-azar is actually present in southern China and that *P. chinensis* is most probably present in Kwangtung and Kwangsi. Its presence in a locality may be easily overlooked owing to the shortness of its season [**16** 169].

Pereira Barretto (M.). **Observações sobre a biologia do *Phlebotomus intermedius* Lutz e Neiva, 1912 (Diptera, Psychodidae) em condições experimentais.**—*An. Fac. Med. Univ. S. Paulo* **16** pt. 1 pp. 143–157, 2 pls., 12 refs. São Paulo, 1940. (With a Summary in English.) [Recd. 1942.]

The author briefly reviews the literature on the technique of breeding sandflies of the genus *Phlebotomus*, with special reference to *P. intermedius*, Lutz & Neiva, in Brazil and gives the results of his own experiments with this species. The stock was derived from females taken in the outskirts of São Paulo City, and they were kept singly in glass tubes, 7 cm. long and 2·8 cm. across with wet filter paper at the bottom. They were allowed to complete a blood meal on volunteers, and the tubes were then closed with muslin and placed in chambers with an almost saturated atmosphere, which were kept under conditions of semi-darkness either at laboratory temperatures of 18·1–26·5°C. [64·58–79·7°F.] or at 26–27°C. [78·8–80·6°F.]. In both series, eggs were laid 3–8 days after the blood meal, but about 35 per cent. of the females died without ovipositing. Most females oviposited once only, but some fed and oviposited a second time; one such laid batches of 40 and 38 eggs. The eggs were generally laid on the filter paper, and the number per batch varied from 2 to 54. The papers bearing the eggs were transferred to petri dishes, and the larvae began to feed about 30 minutes after hatching. The best food was soil rich in decomposing vegetable matter collected at the place where the adults were taken. It was dried, powdered, and kept at 56–60°C. [132·8–140°F.] for some hours in order to destroy possible enemies of the eggs and

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larvae. The larvae preferred a medium that had been " matured," and this was effected by moistening the material, keeping it for 15 days at 56–60°C. and then powdering it once more. This process rendered the material more homogeneous and freed it from fungi. It was then placed in petri dishes lined with moist filter paper and was itself slightly moistened if necessary. The optimum humidity for the eggs and young larvae was an almost saturated atmosphere. As the larvae grew older, however, they needed less humidity, and the pupae required very little. Larvae developed more regularly in semi darkness than in bright light. At the optimum temperature of 26–27°C. the egg, larval and pupal stages lasted 9, 19 and 8 days, respectively ; development was retarded at somewhat lower temperatures, and the mortality increased at higher ones until at 30°C. [86°F.] the eggs did not hatch and the larvae died within 24 hours. Observations on the resultant adults indicated that they need a high degree of humidity and that their survival depends on nutrition. At 24–25°C. [75·2–77°F.] males and females fed on water and sugar lived for up to 8 days, and females given blood meals survived for up to 14 days. Pairing occurred shortly after the blood meal, and oviposition 6–8 days later. The females rarely survived oviposition.

Pereira Barretto (M.) & Coutinho (J. O.). **Processos de captura, transporte, dissecção e montagem de flebótomos.**—*An. Fac. Med. Univ. S. Paulo* **16** pt. 1 pp. 173–187, 3 pls., 8 refs. São Paulo, 1940. (With a Summary in English.) [Recd. 1942.]

Sandflies of the genus *Phlebotomus* can be caught in Brazil in dwellings, in animal quarters, such as fowl-houses, stables, etc., or in forests. Females can be taken in forests on man and animals and in traps baited with the latter, while both sexes are attracted to light-traps. Traps of various kinds are described, including that devised by Shannon [*R.A.E.*, B **27** 193], and methods of transporting, dissecting and mounting specimens are reviewed.

Davis (G. E.), Wynns (H. L.) & Beck (M. D.). **Relapsing Fever : *Ornithodoros parkeri* a Vector in California.**—*Publ. Hlth Rep.* **56** no. 51 pp. 2426–2428, 3 refs. Washington, D.C., 1941.

Ornithodoros parkeri, Cooley, was found in July 1940 in large numbers in the sandy soil of a cave in central California where a case of relapsing fever had originated after tick bites two months earlier. This is the first reported case of relapsing fever attributable to *O. parkeri* [*cf. R.A.E.*, B **29** 145 ; **30** 90]. A case occurred in the same locality in 1937, but the source of the infection was not determined. A series of uninfected nymphs of *O. parkeri* allowed to engorge on mice infected with a strain of spirochaetes recovered from the ticks collected in 1940 transmitted relapsing fever to mice and guineapigs, and nymphs that had fed on mice infected with a strain recovered from ticks of the same species collected in another county in central California in 1939 transmitted it to mice.

Davis (G. E.). *Ornithodoros parkeri* **and Relapsing Fever Spirochetes in Utah.**—*Publ. Hlth Rep.* **56** no. 52 pp. 2464–2468, 1 map. Washington, D.C., 1941.

In a survey carried out between 31st August and 8th September 1940 in parts of 16 countries in southern, central and eastern Utah, 49 lots of *Ornithodoros* each comprising 1–59 individuals were collected in 6 countries, and all were found to consist of *O. parkeri*, Cooley, except for a single specimen of *O. turicata*, Dugès, from the arid area south-east of the Colorado River. This is the first record of *O. turicata* in Utah. The total number of *O. parkeri* collected was

306, of which 235 survived for testing. Relapsing-fever spirochaetes were recovered from seven lots representing four countries. One of the strains of spirochaetes was studied in mice, rats and guineapigs, by allowing uninfected nymphs of *O. parkeri* to engorge on an infected mouse and subsequently on normal animals. Relapses were observed in all three hosts. The appearance of spirochaetes in the ear blood of the guineapigs closely paralleled a rise in temperature.

MOHLER (J. R.). **Report of the Chief of the Bureau of Animal Industry, 19[40–]41.**—92 pp. Washington, D.C., U.S. Dep. Agric., 1941.

A report is given of the progress made during the year ending 30th June 1941 in the campaign for the eradication of *Boophilus annulatus*, Say, on cattle and other animals in the United States and in Porto Rico and the Virgin Islands, where the tropical variety *microplus*, Can. (*australis*, Fuller) is prevalent. The situation in the United States changed little in comparison with the previous year [*R.A.E.*, B **29** 119], though the total area under quarantine was slightly reduced. The remainder of Porto Rico and St. Thomas and St. John were released from quarantine, and progress was made in the removal of tick-infested deer from St. Croix.

Experiments continued in Colorado, Texas and New Mexico on the effectiveness in the control of *Hypoderma lineatum*, Vill., on cattle of washes of derris and cubé powder [*cf.* **30** 10] mixed at the time of treatment and washes containing derris and soap powders or 12 oz. derris and 4, 6 and 8 oz. fused bentonite sulphur compounded and stored dry for 30 days before use indicated the existence of little, if any, difference in the relative effectiveness of the various washes. The first treatment was made 30 days after the first larval openings appeared and was sometimes followed by a second after 37–40 days. The washes containing soap penetrated the hair better than those containing bentonite sulphur. The percentage effectiveness of single treatments varied from 60 to 100, with an average of about 90. The washes reached maximum effectiveness in 10–15 days and ceased to be effective 25–30 days after application. Two treatments with derris washes failed to give complete kill. One application to cattle and goats infested with various species of lice of a wash or spray of 1 lb. derris powder containing 5 per cent. rotenone in 100 U.S. gals. water or a dust of 10 per cent. of the derris powder in an inert carrier killed all lice but not the eggs. Two treatments at an interval of 16–17 days eradicated the lice.

VAN ES (L.) & OLNEY (J. F.). **Poultry Diseases and Parasites.**—*Bull. Neb. agric. Exp. Sta.* no. 332, 90 pp., 36 figs. Lincoln, Neb., 1941.

This bulletin on the diseases and parasites of fowls in Nebraska includes a section (pp. 81–90) on Arthropod ectoparasites. It consists chiefly of notes on the habits and control of the various lice and mites that are of importance in the State.

ALICATA (J. E.). **Experimental Transmission of Endemic Typhus Fever by the Sticktight Flea,** *Echidnophaga gallinacea*.—*J. Wash. Acad. Sci.* **32** no. 2 pp. 57–60, 2 figs., 9 refs. Menasha, Wis., 1942.

The experiments described were carried out with a laboratory (Wilmington) strain of endemic typhus and examples of *Echidnophaga gallinacea*, Westw., obtained from a dog in Honolulu. The fleas were allowed to feed for 13 days on an artificially infected rat, and 82 of them were then kept overnight in a test tube. Next day, a suspension of their bodies was injected into one guinea-pig and a suspension of their faeces into another. Both became infected, and the identity of the infection was proved by the usual tests.

E. gallinacea has recently been found to be naturally infected with endemic typhus in Georgia [*R.A.E.*, B **30** 14]. It is common on rats in the Hawaiian Islands [**23** 157] as well as on dogs, cats, the mongoose and fowls.

Johnson (C. G.). **The Ecology of the Bed-bug, *Cimex lectularius* L., in Britain. Report on Research, 1935–40.**—*J. Hyg.* **41** no. 4 pp. 345–461, 39 figs., 50 refs. London, 1942.

This important and extensive work on the ecology of *Cimex lectularius*, L., in Britain comprises the results of six years' studies undertaken in view of the lack of precise information on certain aspects of its life-history and habits disclosed by the report published in 1934 by a committee on the eradication of bed-bugs appointed by the Minister of Health [*R.A.E.*, B **22** 131]. Results obtained by other workers are incorporated where relevant.

The first part, which makes up the bulk of the paper, consists of an account of laboratory experiments on the influence of environment on rate of development and percentage survival in various stages, the effect of environment, feeding, inbreeding, pairing and the presence of males on egg production, and the periods of survival of fed and starved adults and of starved nymphs. In previous work, the temperature range 0–23°C. [32–73·4°F.] was almost entirely neglected. Surveys of house temperatures in London throughout the year showed it to include almost the whole of the range at which bed-bugs live in Britain, and the present experiments were planned to cover it entirely. Temperature was the important environmental factor. Some results are given of observations on populations of bed-bugs living on caged mice, kept by a method described in an appendix. The first part includes also the results of observations on the composition of populations in nature, alternative hosts, and the habits of the bed-bugs.

In the second part, which occupies some 18 pages, an impression is given of the state of bed-bug populations throughout the year built up deductively from the data given in the first part. Subjects for future research are suggested in a second appendix.

Neiva (A.) & Lent (H.). **Sinopse dos triatomideos.** [A Catalogue of Triatomids.]—*Rev. Ent.* **12** pt. 1–2 pp. 61–92, 28 figs. Rio de Janeiro, 1941.

A list is given of the 89 Triatomids considered valid by the authors, showing their synonyms and distribution and whether they have been found naturally infected with *Trypanosoma* (*Schizotrypanum*) *cruzi* or have been infected experimentally, together with a key to the genera and a list of countries showing the species that occur in them. *Triatoma brasiliensis melanica*, subsp. n., which was found naturally infected with *T. cruzi* in Brazil in 1940, is described.

Carr (H. P.) & Fernández Meléndez (J.). **Malaria Reconnaissance of the Province of Pinar del Río in Cuba.**—*Amer. J. trop. Med.* **22** no. 1 pp. 51–61, 1 map, 4 refs. Baltimore, Md., 1942.

Carr (H. P.), Fernández Meléndez (J.), Ros (A.) & Fernández Meléndez (A.). **Malaria Reconnaissance of the Province of Havana in Cuba.**—*T. c.* pp. 63–71, 1 map, 4 refs.

The results of malaria surveys in two further Provinces of Cuba [*cf. R.A.E.*, B **30** 106] are given in these papers. In Pinar del Río Province, 16,855 children (about 6 per cent. of the total population) were examined for splenomegaly and 7,407 for malaria parasites, and the parasite rate was found to be significantly higher in children with enlarged spleens than in those with normal ones. *Plasmodium vivax* and *P. falciparum* were both well distributed throughout the Province, the former occurring almost twice as frequently as the latter.

The endemicity of malaria is shown to be moderate in the low coastal plain area of five counties ; in the remainder of the Province, it is light with recurring epidemics when conditions are unusually favourable for Anopheline breeding. There was evidence that the last province-wide epidemic occurred in 1934–35. The Anophelines found were *Anopheles albimanus*, Wied., *A. crucians*, Wied., *A. grabhami*, Theo., *A. vestitipennis*, D. & K., and *A. atropos*, D. & K. *A. albimanus* predominated throughout the coastal area, in the low parts of which it was present in far greater numbers than elsewhere, its season of maximum prevalence coincided with the malaria transmission season, and it is concluded that it is the important vector in the Province.

Havana Province is predominantly flat, and the soil is extremely well drained and unfavourable to mosquito production, but along considerable stretches of the shores there are narrow strips of mangrove swamps containing sea water more or less diluted by fresh-water springs. Breeding places for *A. albimanus* are provided by these swamps when the dilution reaches 50 per cent. sea water or less, by pools in a river valley where the soil is comparatively impervious, and by old borrow pits. Examination of 19,188 children for splenomegaly and 9,982 for malaria parasites showed that the incidence of endemic malaria was, as a whole, low except in small localised foci related to breeding places of the type described. There was no significant parasite index. Very small numbers of *A. crucians*, *A. vestitipennis* and *A. grabhami* were found, but these species are not thought to be concerned in the transmission of such endemic malaria as exists.

Rozeboom (L. E.) & Laird (R. L.). *Anopheles* (*Kerteszia*) *bellator* **Dyar and Knab as a Vector of Malaria in Trinidad, British West Indies.**—*Amer. J. trop. Med.* **22** no. 1 pp. 83–91, 3 refs. Baltimore, Md., 1942.

Quotations of some length are made from the Surgeon-General's report for 1934 by E. J. de Verteuil in which he shows that the vector of malaria in the cacao-growing districts in the interior of Trinidad is *Anopheles bellator*, D. & K., and that it breeds in the water held by Bromeliads growing on the immortelles [*Erythrina*] which are planted as shade trees [*cf. R.A.E.*, B **25** 107]. As the reduction of malaria there is of importance to the United States military forces and the control of *A. bellator* would involve rather heavy expenditure, further observations were made in an intensely malarious area, and the belief that it is a dangerous vector was confirmed. The other Anophelines found were *A. mediopunctatus*, Theo., and *A. nimbus*, Theo., which were rare, and *A. oswaldoi*, Peryassú, which was collected regularly, but was not abundant enough to be involved in the transmission of malaria. *A. bellator*, which constituted 95·7 per cent. of the adults taken, was present in great numbers. Although attracted to cows and donkeys, it seemed to prefer the blood of man to that of animals. *A. oswaldoi* fed readily on man, but appeared to be associated primarily with animals, especially cattle. *A. bellator* attacked man throughout the afternoon, especially on dark days and in the shade of the forest, but the real flight lasted from about 5.30 to 8 p.m., the peak occurring between 6.30 and 7. There was another period of activity between 4 and 6.30 a.m., but the morning flight was light as compared with the evening one, when the females swarmed about people, attacking viciously. They would enter houses and even bed nets in search of human blood, but attacked more readily out of doors or under the roofs of wall-less sheds. After feeding, they returned immediately to their jungle resting places [*cf.* **29** 173]. The larvae of *A. bellator* were found only in Bromeliads, and only in two of the four species examined. These two belong to the genera *Gravisia*, in which they were most numerous, and *Wittmackia*.

Because of the lack of suitable gametocyte carriers, attempts to infect *A. bellator* with *Plasmodium* were mostly unsuccessful, but in one experiment

in which 15 females that had fed on a woman suffering from a fever were dissected, six were found to be infected with 5–85 oöcysts each, and sporozoites were seen in the salivary glands of one 9 days after the infective meal. In another experiment a single small oöcyst was found in a female on the fifth day after feeding on a boy infected with *P. vivax*, and two out of four females of *A. oswaldoi* that fed on the same case were found to be infected on the sixth day, one with two and the other with five small oöcysts. Three out of 725 females of *A. bellator* dissected were found to be naturally infected with *Plasmodium*, one had a single mature oöcyst on the stomach wall, another had infected salivary glands, and the third had nine small oöcysts on the stomach wall.

MISRA (A. K.). **A Method of oiling Streams and Drains by an Automatic Drip System.**—*Indian med. Gaz.* **76** no. 12 pp. 739–740, 2 figs. Calcutta, 1941.

Brief descriptions are given of two methods of automatically oiling streams and drains for the control of Anopheline larvae, both of which are suitable for use in Assam in the dry season when the flow of water is not sufficient to effect control by natural flushing. In the first, a bottle for the oil has a cork through which a length of $\frac{1}{4}$ in. glass tubing is passed in such a way that about $\frac{1}{2}$ in. of tubing projects on each end of the cork. Stems of dried thatch-grass about 6 ins. long are inserted in the tubing with about 1–2 ins. projecting on the outside, and the bottle is fastened in an inverted position to a rod about 4ft. long fixed in the stream bed. If the oil is strained, blockage rarely occurs. In the second method, a fairly wide-mouthed bottle is needed and two $\frac{1}{8}$ in. glass tubes are inserted through the cork. The bottle is anchored in the stream, with the mouth facing the flow. The current gradually forces water into the bottle and an equivalent amount of oil into the stream. This method is as efficient as the first, but needs more care.

SMITH (R. O. A.), HALDER (K. C.) & AHMED (I.). **Further Investigations on the Transmission of Kala-azar. Part IV. The Duration of Life and other Observations on "blocked" Flies.**—*Indian J. med. Res.* **29** no. 4 pp. 783–787, 2 figs., 1 ref. Calcutta, 1941. **Part VI. A second Series of Transmissions of *L. donovani* by *P. argentipes*.**—*T. c.* pp. 799–802, 1 ref.

Further experiments on the feeding of *Phlebotomus argentipes*, Ann. & Brun., on cases of visceral leishmaniasis were begun on 6th May 1940, and the first "blocked" sandfly [*cf. K.A.E.*, B **28** 155; **29** 85] was found on 25th. Others were detected every month until the end of October. The temperature during this period varied from 79 to 87°F. The sandflies were divided into two series, one of which was given repeated blood-meals while the other was maintained on raisins [*cf. loc. cit*]. In no instance was a "blocked" fly found among those given repeated blood-meals; the condition was observed exclusively among the sandflies fed on raisins and only among those being offered a second blood-meal. Of sandflies suspected of being "blocked," 77 were proved on dissection to be infected with flagellates and 9 were negative. Of the positive sandflies, 39, 13, 13, 6, 1 and 1 died on the first, second, third, fourth, fifth and seventh days, respectively, the remaining four having been prepared for section cutting. Most of these sandflies tried to feed at least once each day when given the opportunity, and most of those that refused to try were found dead next morning. Many made sustained efforts to obtain a blood-meal two or three times on the same day, if given the opportunity at intervals of an hour or so. After being offered a blood-meal, the "blocked" sandflies were put in tubes with raisins from which, it is assumed, they were able to obtain some nourishment. The repeated and persistent efforts made by "blocked" sandflies to obtain a meal suggest that infection with *Leishmania donovani* under natural conditions results from repeated bites made probably throughout a night on a person sleeping in a

particular part of the room favoured by sandflies. This would be one explanation of the slow spread of kala-azar generally. The number of naturally-infected sandflies found up to date is remarkably small and quite out of proportion to the incidence of the disease in endemic areas in India, but those that are " blocked " have empty midguts and cannot easily be distinguished from newly emerged and unfed females so that it is possible that many of them escape examination. Camera lucida drawings are given of the anterior halves of the alimentary canals of a " blocked " sandfly and an ordinarily infected one that died after the fifth blood-meal.

The transmission of *L. donovani* to hamsters [*Cricetulus*] by the bites of *P. argentipes* was repeated in 1940 to determine whether the successful results obtained in 1939 [**29** 85] were dependent on the new method of feeding and keeping the sandflies or on the virulence of the local strain of parasite. Ten hamsters were exposed to sandflies that had received preliminary infecting meals from the same patients, and about ten sandflies were known to have fed on each hamster. The five bitten by sandflies maintained according to the new method became infected, and four of those exposed to the bites of sandflies that had been given repeated blood-meals were negative, while the fifth escaped. It is concluded that the nature of the case from which the sandflies derive an infection does not make an appreciable difference in the transmission results. Of mice bitten by infected sandflies, 4 became infected and 8 did not. The fact that it was not the mice that received the largest numbers of bites that became infected suggests that there is possibly a certain degree of individual variation in the susceptibility of these animals to leishmaniasis.

ADLER (S.) & BER (M.). **The Transmission of *Leishmania tropica* by the Bite of *Phlebotomus papatasii*.—*Indian J. med. Res.* 29** no. 4 pp. 803–809, 1 pl., 4 refs. Calcutta, 1941.

An account is given of experiments begun on 1st January and still in progress on 20th April 1941 in which 26 females of *Phlebotomus papatasii*, Scop., that belonged to the first and second generations bred from sandflies caught in Jerusalem, were infected with *Leishmania tropica* by feeding on flagellates suspended in three parts 2·7 per cent. saline and one part defibrinated blood, kept at a temperature of 30°C. [86°F.] and re-fed on nine human volunteers, five of whom had become infected by 20th April. These five volunteers were fed upon by 9, 3, 2, 5 and 15 sandflies and developed 18, 2, 1, 6 and 1 lesions, respectively. Several sandflies fed on more than one volunteer, the total of individual feeds involved was 47, of which at least 4 were not concerned with transmission, and the details of the experiments showed that individual sandflies can produce more than one lesion and that transmission can occur when a sandfly inserts its proboscis without ingesting blood. The lesions occurred on the exact site of the bites of the sandflies.

The cause of negative results obtained in previous experiments on the transmission of *L. tropica* by *P. papatasii* [*cf. R.A.E.*, B **17** 148] is discussed. It is thought that failure occurred in many cases because the flagellates did not invade the distal part of the epipharynx, and that intensity of infection in the sandfly, though important, is not the only factor determining the invasion of the epipharynx by the flagellates. The chitinous inferior surface of the epipharynx acts in many sandflies as an effective barrier to the forward passage of flagellates. It seems probable that physiological conditions in the insect determine the properties of this surface ; the only difference between the sandflies used in the experiments described and those that had previously given negative results were that the former were kept at a constant temperature of 30°C. and that the suspension used for their infecting feed contained a much higher concentration of salt. In the Jordan Valley, where *P. papatasii* is the

only vector of *L. tropica*, oriental sore is rare in the northern part and very common near the Dead Sea, where the soil has a higher salinity and presumably the food of the larvae contains more salt.

JOB (T. J.). **Food and feeding Habits of the Glassfishes (*Ambassis* Cuv. & Val.) and their Bearing on the biological Control of Guinea-worm and Malaria.**—*Indian J. med. Res.* **29** no. 4 pp. 851–862, 2 figs., 25 refs. Calcutta, 1941.

The following is based on the author's summary. Analyses of the gut-contents of 268 specimens of *Ambassis nama* and 313 of *A. ranga* collected from malarious areas of Bengal in 1939 and 1940 showed that these glassfish feed at all layers of water, subsisting mainly on the minute Entomostraca that occur abundantly in the mid-water plankton. Their mouth and gill apparatus are well adapted for the filtration of such microfauna. To a small extent, they perform typical sight feeding also, and consume mosquito larvae, mostly Culicines, from the sub-surface and worms from the bottom. Field experiments carried out in railway borrowpits showed that the presence of the fish checks mosquito breeding only to a small extent, though it effectively reduces the density of *Cyclops*. Starved glassfish under the artificial conditions of an aquarium feed by sight far more than by filtration and consume large, conspicuous organisms more than the microfauna.

STRICKLAND (C.) & ROY (D. N.). **Myiasis-producing Diptera in Man.**—*Indian J. med. Res.* **29** no. 4 pp. 863–865, 5 refs. Calcutta, 1941.

Collections of Muscoid larvae from 32 cases of human myiasis (15 of which were intestinal) were received from various parts of India and Burma between 1922 and 1941. Attempts were made to rear those that were living, and a table is given showing the flies concerned in 14 cases, the sites of infestation and the Provinces in which they were found. *Chrysomia bezziana*, Villen., was the species in the one case from Burma, and *C. bezziana* and *Sarcophaga* spp. were concerned, separately or together, in 10 of the 13 Indian cases. *C. bezziana*, which was not identified from intestinal cases, was the only biontophagous species, but none of the patients showed any symptom that could be ascribed to the presence of either biontophagous or saprophagous larvae.

HAFEZ (M.). **Investigations into the Problem of Fly Control in Egypt.**—*Bull. Soc. Fouad Ier Ent.* **25** pp. 99–144, 2 figs., 101 refs. Cairo, 1941.

This paper deals with extensive field observations and experiments on fly control in rural and urban areas of Egypt made over a period of about two years. Typical observations on breeding media and oviposition experiments are described for the principal species or groups of species considered. It is shown that *Musca domestica vicina*, Macq., the most abundant and important of the house-frequenting flies that may carry the causal organisms of prevalent diseases, utilises as breeding media, in addition to horse and donkey dung [*R.A.E.*, B **28** 210], human excrement, which is allowed to accumulate in heaps in or near the villages, and to a smaller extent, the dung of sheep and goats. The latter is more important than pig dung. Breeding also takes place in heaps of mixed dung containing a proportion of favoured kinds and in fowl droppings and household refuse, but hardly at all in cow or buffalo dung alone. *M. vetustissima*, Wlk., *M. sorbens*, Wied., *M. vitripennis*, Mg., *M. tempestiva*, Fall., *M. nebulo*, F., and *Philaematomyia* (*M.*) *crassirostris*, Stein, which are scarce in towns, breed chiefly in cow and buffalo dung in byres and in heaps on the farms, as the temperature generated during fermentation is only 30–35°C. [86–95°F.] and is very favourable to their development. Sheep and goat dung and human excrement are also attractive, the last particularly

to *M. tempestiva* and *M. sorbens*. These two species will also breed in horse dung, particularly when it is mixed with that of bovines. Pig, donkey and fowl dung and household refuse are unattractive. *Stomoxys calcitrans*, L., breeds in the bedding in byres and calf pens in the country and in horse bedding removed from stables and exposed in the open near towns, but pure dung is not very attractive to it. Donkey dung deposited in stables and mixed with litter is sometimes used in the country, but sheep, goat and pig dung and human excrement very seldom. *Calliphora erythrocephala*, Mg., *Lucilia sericata*, Mg., and *Muscina stabulans*, Fall., are chiefly attracted to carrion, but owing to its rare occurrence, breed chiefly in human excrement. *M. stabulans* may breed in cow and horse dung and occasionally in household refuse.

The efficiency of various methods for the control of breeding in horse dung was tested, and their value is discussed. It is concluded that the most effective method is to induce fermentation, which will raise the temperature of the breeding medium above the lethal limit, by packing and watering the dung and turning over the upper layer in a receptable designed for the purpose. It is a rectangular three-sided wooden box, about 6 ft. long, 3 ft. wide and 20 ins. high, lined with zinc. The open front has a channel in which larvae that develop in the cooler outer layers of dung and try to escape are trapped in borax solution (4 oz. borax to 1½ gals. water), and there is a ledge projecting inwards to prevent any larvae from escaping upwards. The channel is protected from falling manure by a shutter. Two boxes are kept for alternate use. Dung is rammed into one every day until it is full, but a space of 10 ins. must be left between the manure and the channel and one of 6 ins. between the surface of the heap and the projecting ledges. The borax solution is renewed daily after the liquid manure has been drained from the channel when the box is full, the shutter is fitted to the front and the dung left to finish fermenting, the surface being turned over and water added daily. During this time, the second box is filled. The temperature generated in the centre of the heap (66–92°C. [150·8–197·6°F.]) is sufficient to destroy all immature stages. A table is given showing the period of exposure to temperatures varying from 45 to 55°C. [113 to 131°F.] necessary to kill larvae in various stages of development. The longest exposure required was 10 minutes for mature larvae at 45°C. Although the upper surface of the manure is left exposed, no oviposition takes place in it as the fermenting dung brought to the surface is repellent. No eggs were laid when the dung was exposed after fermentation was complete. The value of the dung as a fertiliser is not impaired.

It is recommended that this method be used in conjunction with supplementary measures such as the application of insecticides. In stables for animals other than horses, bedding, which should be of straw, should be changed frequently and exposed to dry so as to kill developing larvae, and dung should be accumulated outside the stable and dried in disks to be used as fuel [*loc. cit.*]. This practice, which is a common method of disposing of cow and buffalo dung, is described. It was found that third-instar larvae can complete development in the disks, but younger ones cannot. The dung must, therefore, be dealt with within 24 hours, so that the disks when formed do not contain third-instar larvae. The number of flies on farms where this practice was adopted was reduced to a tolerable minimum within about a month. On large farms, the dung is accumulated in very large stacks for use on the fields. The biothermic method was not successful in dealing with them as the heat generated in cow and buffalo dung during fermentation is not lethal to the larvae. It is recommended that such heaps should be kept to a manageable size, a solution of 1½ oz. borax in 2½ gals. water sprinkled over the heap, the fresh dung buried in the centre and the surface covered with a thick layer of dry soil. Five substances were tested for their larvicidal value when used for treating human excrement. Kerosene and phenol were ineffective, chloride of lime had good larvicidal and repellent properties, but borax at 2 oz. in 1 gal.

water was the most effective. After treatment, the excrement should be covered with a thick layer of earth to prevent the odour from attracting the flies. In addition to these methods directed against breeding on a large scale, breeding in smaller accumulations of media should be reduced to a minimum by promptly burning garbage, disposing of the contents of cesspits at a place about a mile from the town or village and covering them with earth, cleaning roads, yards, etc., removing the fowl dung accumulated in houses and burying dead animals.

HAFEZ (M.). **A Study of the Biology of the Egyptian Common House-fly: *Musca vicina* Macq. (Diptera: Muscidae).**—*Bull. Soc. Fouad 1er Ent.* **25** pp. 163–189, 9 figs., 51 refs. Cairo, 1941.

An account is given of observations made on the bionomics of *Musca domestica vicina*, Macq., in Egypt, and the immature stages are described. It occurs throughout the year, but is most abundant from April to June and in September, when the temperature ranges from 28 to 35°C. [82·4–95°F.]. During the summer, the temperature may become high enough to prevent oviposition and development of the early stages, and breeding in the winter is confined to places such as stables, where temperature is favourable and food and humidity are available. Local distribution depends on the availability of the kinds of dung, etc., that are favourable breeding media [see preceding abstract]. The adults are most active at 28–35°C., rather less so at higher temperatures and inactive in the winter. Experiments indicated that they can withstand a temperature as low as −7°C. [19·4°F.] for 6 hours, but they died when exposed to −11°C. [12·2°F.] for 3 hours. They are attracted to light and seldom oviposit in the dark, but experiments failed to show that they displayed any colour preference. The maximum duration of adult life in confinement varied in observations made in 1939 from 18 days in May to 70 days in winter.

When a batch of flies was kept in a glass vessel with pig dung at 25–30°C. [77–86°F.], pairing began about 5 days after emergence, and oviposition 2 or 3 days later. At 31°C. [87·8°F.], pairing began about 3 days after emergence and oviposition 2 days after pairing, but sometimes oviposition was delayed until 9 days after emergence. Eggs are laid in masses or clusters within the breeding medium or occasionally on the surface in dark situations. The duration of the egg stage varied from 6 hours at 35–38°C. [95–100·4°F.] to 40 hours at 10–15°C. [50–59°F.]. It was 11 hours at 25–30°C. The three larval instars and pupal stage lasted about 15 hours, 20 hours, 2 days and 3 days, respectively, at about 30°C. and about 20 hours, 30 hours, 3 days and 4 days at 20–26°C. [68–78·8°F.]. The larva is very active during the last instar. This instar and the pupal stage are passed in the lower layers of the dung or on the soil below it. In experiments at controlled temperatures, the duration of the immature stages varied from 5 days 6 hours at 38°C. to 19 days 8 hours at 13°C. [55·4°F.]. Larval mortality was very heavy in the few experiments carried out at 40°C. [104°F.]. The heat generated during fermentation in cow dung, human excrement and some decomposing vegetable matter (about 30–35°C.) accelerated development, but that generated in horse, donkey and pig dung was high enough to be fatal. The fly breeding capacity of cow, horse and donkey dung was reduced with the progress of fermentation, but that of pig dung was retained much longer. Larvae reared in horse dung that dried up naturally developed in 19 days, while those kept in identical conditions except that the dung was moistened with water or urine whenever it began to dry up developed in 10 days. Under identical conditions, larvae completed development in 8 days in pig and horse dung, 10 days in sheep dung, 14 days in human excrement and about 20 days in kitchen refuse.

CHARTERS (A. D.). **Relapsing Fever in Abyssinia.**—*Trans. R. Soc. trop. Med. Hyg.* **35** no. 5 pp. 271–279. London, 1942.

During examination of cases of relapsing fever that occurred at Soddu in the Lake District of Abyssinia in July and August 1941, spirochaetes were found in the contents of the ruptured guts of two individuals of *Pediculus humanus*, L. (*corporis*, DeG.) taken on the clothes of one patient and on the out-patient card of another. The guts also contained disintegrating human blood cells. Both lice were heavily infected, whereas the patients' blood slides contained such small numbers of spirochaetes that these were found only with difficulty, although the slides were taken at the time of the removal of the lice. It seems probable, therefore, that the spirochaetes had multiplied in the insects' guts. The local Abyssinian natives are often heavily infested with lice.

MORISON (G. D.). **Sheep Strike by the Fly, *Phormia terrae-novae* R.-D., in North-east Scotland.**—*Nature* **149** no. 3778 p. 358, 5 refs. London, 1942.

The flies that emerged from 11 batches of maggots obtained from sheep on widely scattered farms in north-eastern Scotland in May 1941 and reared by W. Moore under fly-proof conditions with the object of building up a supply of *Lucilia sericata*, Mg., proved to be *Phormia terraenovae*, R.-D. This is the first record of this species, which seemed to be the cause of primary strike in many cases [*cf. R.A.E.*, B **26** 83], infesting sheep in north-eastern Scotland, where it is abundant. Larvae of *L. sericata* were not obtained from sheep until the second week of July; they were then mixed with *P. terraenovae* in two cases. Later, infestation by *L. sericata* seemed to become general. Strike was prevalent in north-eastern Scotland in 1941, and much of it may well have been due to *P. terraenovae*, at least early in the year. Very little is known about the habits and life-history of this fly in Great Britain. Some adults apparently hibernate, as a female was caught by the author in April 1929, and a male on 30th March and a female on 9th April in 1930, in the loft of a house in Aberdeen. The adults reach their maximum numbers towards the end of July and disappear from the open during September and October. Between 18th July and 10th October 1933, 799 females and 559 males, as compared with 863 and 96 of *L. sericata*, were taken in a trap in a garden in a suburb of Aberdeen, and between 13th June and 27th July 1934, 1,915 females and 1,078 males, as compared with 2,249 and 265 of *L. sericata*, were taken in five traps on a farm in the neighbourhood. The traps were baited with carrion, which is highly attractive to the flies though rarely used for breeding [*cf.* **26** 240].

JOHNSTONE (I. L.) & GRAHAM (N. P. H.). **Studies on Fly Strike in Merino Sheep. No. 6. Comparison of the Incidence of Crutch Strike in Plain-breeched Sheep and in Wrinkly-breeched Sheep treated by the Mules Operation.**—*J. Coun. sci. industr. Res. Aust.* **14** no. 4 pp. 229–232. Melbourne, 1941.

Two days after the shearing of a flock of merino ewes in Queensland in June 1940, the plain-breeched sheep, numbering 530, were separated, 600 of the remainder were left as a control and 600 were treated by Mules' operation [*cf. R.A.E.*, B **27** 197, etc.]. Only the median breech fold was removed in the treated group. Blowflies were active from August to October, and in the four musterings during this period, the percentage of sheep that incurred true crutch strikes was never greater than 1·0 in the plain group or 0·3 in the treated group, whereas it ranged from 2·3 to 8·7 in the control group. Attacks ceased in November and December, but became serious in January 1941; on 3rd February, the percentages of sheep in the three groups having true crutch strikes were 8·6, 0·7 and 31·1, respectively, and all the sheep were crutched. In March, only sheep in the control group were struck, the percentage of these

receiving crutch strikes being 3·4. In three musterings during April and May, the percentages of true crutch strike were 0·6–2·5, 0·0–0·2 and 6·1–11·8, respectively, in plain, treated and control groups. The very brief period of protection that crutching gave to the control group was attributable to the difficulty of crutching such sheep efficiently. When the sheep were classed in May, the percentages culled from the plain, treated and control groups were 26·6, 31·1 and 48·6, respectively, so that crutch strikes that could have been prevented by Mules' operation were responsible for the rejection of 17 per cent. of the control group.

CARTER (H. B.). **A Skin Disease of Sheep due to an ectoparasitic Mite, *Psorergates ovis* Womersley 1941.** —*Aust. vet. J.* **17** no. 6 pp. 193–201, 2 pls., 6 figs., 15 refs. Sydney, 1941.

An abnormal condition of the fleece in fine-wool merino sheep in Australia was found to be caused by a mite of the genus *Psorergates*, which was described as *P. ovis* by Womersley in 1941 (*Rec. S. Aust. Mus.* **7** no. 1 p. 56). Womersley's description is quoted, and references to the genus in the literature are reviewed. The presence of the mite causes chronic irritation of the skin and results in much damage to the fleece. The principal lesion is a hyperkeratosis of the skin with much dry, crumbling scurf. The staple becomes stringy, with a dry and spiral-pointed tip, and its tensile strength may be seriously reduced. Some matting may occur in the fleece in advanced cases. Loose tassels of tangled fibres may appear on the sides and thighs, and considerable patches of the fleece may be lost. A small patch or the whole surface of the fleece may be involved. This ragged appearance of the fleece is mainly due to biting and rubbing. Infestation apparently spreads very slowly and may require 3–4 years to become generalised; it may, also, vary from year to year, and disappear temporarily after shearing. Sheep of all ages are susceptible, but infestation appears to be more common in ewes than in wethers or rams. Signs are not obvious in sheep under six months of age. In the flock on which most of these observations were made, the incidence is estimated to have increased from 1 to nearly 15 per cent. over a period of eight years.

The mite is best detected in skin scrapings. Brief recommendations are made for the taking of such scrapings. It may also be detected in serial sections of skin cut parallel to the epidermal surface. It is probably an obligatory parasite with a protracted life-cycle in which all stages are passed on a single host. It is apparently oviparous. Mites of the genus *Psorergates* have previously been recorded only from mice and voles, and it remains to be proved that *P. ovis* cannot exist on the skin of Murids. It is not known whether Murids are infested by *Psorergates* in Australia.

COBB (S.). **Tick Parasites on Cape Cod.**—*Science* **95** no. 2472 p. 503, 3 refs. Lancaster, Pa., 1942.

Hunterellus hookeri, How. (*Ixodiphagus caucurtei*, du Buysson) was released in 1926 on the island of Naushon (Massachusetts) in an attempt to control the dog tick, *Dermacentor variabilis*, Say, and was recovered there in 1927 [*cf. R.A.E.*, B **16** 133]. In July–August 1940, 1,470 engorged immature ticks were collected on the island, 1,354 being *D. variabilis* and the remainder a species of *Ixodes*, probably *I. ricinus scapularis*, Say. From one larva of *D. variabilis* 2 examples of *Ixodiphagus texanus*, How., were obtained. This is believed to be a new host record for this parasite. *H. hookeri* was not obtained from any of the ticks, but 5 adults were taken in the hair of a setter dog, 2 in late July and 3 about 30th August. Since the average life of an adult is about 48 hours, there is probably a fairly large population of this Encyrtid on the island as a parasite of some tick other than *D. variabilis*,

A new Insecticide.—*Science* **95** no. 2473 suppl. pp. 10, 12. Lancaster, Pa., 1942.

A chemical defined as the thiocyanoacetate of a secondary terpene alcohol, which has been obtained in the United States from Southern pine and given the trade name of Thanite, is stated to be an effective substitute for pyrethrum or rotenone in household sprays against mosquitos, cockroaches and other pests. Laboratory tests on flies [*Musca domestica*, L.] showed that it was as effective against females as against males, whereas pyrethrum is not.

[Bashkirova (E. Ya.).] **Башкирова (Е. Я.). Study of the Biology of *Anoplocephala perfoliata* Goeze, 1782.** [In Russian.]—*Vestn. sel.-khoz. Nauk. Vet.* 1941 no. 2 pp. 57–67, 10 figs., 15 refs. Moscow, 1941. (With a Summary in French.)

A detailed account is given of experiments carried out in Moscow from May 1940 to the end of January 1941 to determine whether Oribatid mites, which have been shown to serve as intermediate hosts of certain Anoplocephaline tapeworms [*cf. R.A.E.*, B **28** 135, 196], are also intermediate hosts of *Anoplocephala perfoliata*, which is the chief tapeworm of horses. For this purpose, Oribatids were collected from March to December near Moscow from various natural habitats in woods and fields, the best time for doing so being in early spring and in autumn, when the soil was moist. The methods adopted for rearing them in the laboratory and preparing specimens are described. They were best reared in batches of 1,000 in boxes measuring 4×6 cm., partly filled with moss, leaves, turf, etc., covered with muslin, and kept in a saturated atmosphere at a temperature of 14–16°C. [57·2–60·8° F.]. The eggs of the tapeworm were obtained from horse faeces or, more usually, from mature proglottids found in the intestines of slaughtered horses. Eggs obtained by the latter method in the early summer were immature, but completed their development in 2–3 months in normal saline; the mites that fed on them, however, died prematurely. Mature eggs were obtained from proglottids from mid-August onwards, and over 18,000 mites were fed on them at different periods; some 1,500 were subsequently dissected. The results of one series are given in detail. These mites ingested the eggs on 20th August, and were kept at 18–20°C. [64·4–68° F.]. Onchospheres were present on 21st August, motile onchospheres on 26th August, larvae on 2nd October, segmented larvae and cysticercoids on 15th November, cysticercoids with well-formed scolices on 30th December, and fully formed cysticercoids on 20th January. Development proceeded somewhat more rapidly at a higher temperature, and it is thought that its duration may depend on the season of the year. The various forms observed and their distribution in the mites are described; the mites from which they were obtained included *Galumna obvius*, Berl., *G. nervosus*, Berl., *Scheloribates laevigatus*, Koch, *S. latipes*, Koch, *Achipteria* sp. and several others that were not identified. A few tests were also made with eggs of *Anoplocephala magna* and *Paranoplocephala mamillana*, which also infest horses. Development of the former took place in *Scheloribates* spp., reaching the cysticercoid stage in *S. latipes*, and the latter developed to the larval stage in *Galumna obvius* and *Allogalumna longiplumus*, Berl.

[Sudachenkov (V. V.).] **Судаченков (В. В.). Experiments in the Transmission of Babesiellosis (*Babesiella bovis*—Babes, 1888) of Cattle by the Ticks *Ix. ricinus* L. and *Ix. persulcatus* P. Sch.** [*In Russian.*]—*Vestn. sel.-khoz. Nauk. Vet.* 1941 no. 2 pp. 75–85, 22 refs. Moscow, 1941. (With a Summary in French.)

An account is given of investigations on the transmission by *Ixodes ricinus*, L., and *I. persulcatus*, Schulze, of the form of piroplasmosis of cattle caused by

Piroplasma (*Babesiella*) *bovis*; the ticks were collected in the western and eastern parts of the Province of Leningrad, respectively [*cf. R.A.E.*, B **23** 75]. In the tests with *I. ricinus*, the disease was transmitted to healthy cattle by larvae, nymphs and adults that were the offspring of females that had engorged on infected animals; the nymphs and adults had fed in their preceding stages on immune hosts (hedgehogs and rabbits). Transmission was effected, however, by only some, or by none, of the larvae of individual females. Nymphs and adults taken from infected pastures did not transmit the disease, probably owing to the small proportion of ticks infected in nature. No transmission was effected by nymphs or adults from larvae that failed to transmit, though they were the progeny of females that had engorged on infected animals, by nymphs or adults from larvae that engorged on infected cattle, by adults from nymphs that had done so, or by the larvae from either of these lots of adults. Larvae of the second filial generation from females that had engorged on infected cattle did not transmit the disease, though larvae or nymphs of the first filial generation had transmitted it.

Temperature had no effect on the ability of the ticks to acquire the infection as positive results were obtained whether they fed on infected animals at 27° C. [80·6° F.] or at 1–2° C. [33·8–35·6° F.], and their ability to transmit it was not affected by keeping them for long periods at 27, 20–22 or between −2 and −4° C. [80·6, 68–71·6 or 28·4–24·8° F.]. No relation could be traced between the number of parasites ingested by the ticks and the subsequent rate of infection of their offspring, but ticks taken from animals that had suffered from piroplasmosis 2–12 months before usually transmitted the infection to a much smaller percentage of their offspring than did those that engorged during an acute attack of the disease.

In similar experiments with *I. persulcatus*, larvae from some of a batch of adults taken from infected cattle transmitted the disease, but nymphs from larvae that received an infecting feed did not transmit it, nor did the resulting adults. Further tests gave inconclusive results, but it is thought that the mode of transmission in *I. persulcatus* is the same as in *I. ricinus*, though the former may be more resistant to *P. bovis* and so a much less important vector in nature.

The relation between *P. bovis* and *I. ricinus* differs from that between other forms of piroplasmosis and their tick vectors in that *P. bovis* evidently completes its development before the larvae hatch; consequently, it can be transmitted by larvae, nymphs and adults alike.

[Kurchatov (V. I.).] **Курчатов (В. И.). Experiments in the Application of Pyrethrum for the Control of certain Ectoparasites of domestic Animals.** [*In Russian.*]—*Vestn. sel.-khoz. Nauk. Vet.* 1941 no. 2 pp. 97–103, 23 refs. Moscow, 1941. (With a Summary in French.)

The effectiveness of pyrethrum against Arthropod pests of domestic animals was studied under farm conditions in Azerbaijan in the summer of 1940 and in laboratories. Promising results against Ixodid and Argasid ticks and the mite, *Dermanyssus gallinae*, DeG., were obtained with pyrethrum powders having pyrethrin contents of 0·4–1 per cent., used either alone or mixed with talc or ash, with water suspensions of pyrethrum powder with or without the addition of kerosene and soap, with an emulsion prepared from a paste having a pyrethrin content of 0·06–0·1 per cent., and with ointments made from pyrethrum powder and vaseline or similar substances.

Pyrethrum had a paralysing action, and, in the laboratory, all the preparations gave complete mortality of starved adults within periods ranging from 1–3 hours (in the case of the mite) to 13 days, but considerable percentages of engorged nymphs and adults survived.

In tests under farm conditions, practically all adult ticks on domestic animals were killed if they had not begun to feed; only single individuals of *Hyalomma*

dromedarii, Koch (*asiaticum*, Schulze & Schlottke) and *Rhipicephalus sanguineus*, Latr., survived. If they were feeding, however, the resistance of both nymphs and adult females was directly proportionate to the degree to which they had engorged. *H. dromedarii* and *H. marginatum*, Koch, were the most resistant species, and *R. bursa*, C. & F., and *Haemaphysalis otophila*, Schulze, the least. Many of the partly engorged females dropped from the host before becoming fully engorged, and some died without ovipositing, while others laid only a few eggs, which in many instances did not develop. Nymphs in various stages of feeding dropped from the treated animals in 1–2 days. The adults resulting from nymphs that survived but did not complete feeding were poorly developed and died prematurely. Nymphs of *Hyalomma detritum*, Schulze, and *R. sanguineus* were more resistant than those of *R. bursa*. The ointments were particularly effective, killing practically all the starved and partly engorged adults of *H. detritum* and *Dermacentor marginatus*, Sulz.

Pyrethrum powder was also found to prevent reinfestation by ticks, as all adults of *H. marginatum*, *H. anatolicum*, Koch, and *R. bursa*, and 50 per cent. of those of *H. dromedarii* died when placed on animals 2–48 hours after treatment. Larvae of various ticks died when placed on treated animals within a fortnight. Similar results were observed in the case of nymphs and adults of *Dermanyssus gallinae* on fowls. Pyrethrum powder was also effective against *Haematopinus* on pigs, including larvae that hatched 2–6 days after the treatment, *Menopon gallinae*, L. (*pallidum*, Nitzsch) on fowls, and *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., on a dog.

In the laboratory, most starved adult ticks died after crossing a strip of pyrethrum powder about 4 ins. wide. The rapidity with which death occurred varied directly with the temperature at which they were subsequently kept. When the ticks were placed on animals immediately after having crossed the strip, some of them survived.

[Tzitzin (N. V.).] **Цицин (Н. В.). Pyrethrum.** [*In Russian.*] –80 pp., 26 figs. Moscow, Sel'khozgiz, 1941. Price 1 *rub.*

This booklet on the cultivation and use of pyrethrum in the Russian Union, the main contents of which have been noticed elsewhere [*R.A.E.*, A **30** 454], contains a section (pp. 61–78) on its employment for the control of pests of domestic animals. Most of this section consists of a series of brief accounts of successful experiments under farm conditions or at veterinary stations on the control of ticks, mites, and lice on domestic animals and poultry by dusts of pyrethrum powder or sprays, washes or dips containing emulsions of oil and pyrethrum powder or pyrethrum extract.

[Ioff (I. G.).] **Иоффъ (И. Г.). Questions of the Ecology of Fleas in Connection with their epidemiological Importance.** [*In Russian.*]—116 pp., 3 graphs, 9 figs., 1 fldg. table, 347 refs. Pyatigorsk, Ordzhonik. kraev. Izd., 1941.

This handbook comprises a review of data from various parts of the world on the ecology of fleas, with special reference to the way in which it affects the part they play as vectors of disease, particularly plague. Fleas have been shown to transmit seven diseases of man and animals and are suspected of being vectors of 18 more, so that a knowledge of the way in which they live and the conditions that influence transmission is of great importance.

The book opens with a discussion of the epidemiological importance of fleas and the fate of the causal agent of an infection in the organism of a flea. Subsequent chapters deal with the mechanism of transmission, with special reference to plague; the importance in this respect of different species of fleas; the different types of fleas and their habitats; feeding and host specificity; the correlation between the geographical distribution of fleas and that of their

hosts, and the importance of a study of the flea-indices for the determination of the possibility of plague outbreaks ; the effect of humidity and temperature on fleas ; their longevity in the presence or absence of the host, and the persistance of plague infection in them ; the dependence of their movements on temperature, light and humidity, and their migrations to and from the burrows of their hosts and on the surface of the soil ; and the seasonal fluctuations in their abundance, their natural enemies, and their control in houses, on domestic animals and in the burrows of rodents.

Melnikov (N. N.), Sukhareva (N. D.) & Fedder (M. L.). **Structure and insecticidal Properties of organic Compounds.**—*C. R. Acad. Sci. URSS* **31** no. 6 pp. 610–613, 24 refs. Moscow, 1941.

Since systematic investigation of large groups of organic compounds would probably show that certain substances non-injurious to man and the higher animals possess insecticidal properties and so could be used to control the vectors of diseases known to be transmitted by insects, a series of esters of chloroacetic, thiocyanoacetic and α-thiocyanobutyric acids were synthesised by methods that are described, and the minimum concentrations, in emulsions of soap and water, lethal to *Pediculus humanus*, L. (*vestimenti*, Nitzsch) were determined by immersion. Ethyl acetate and pentyl acetate were used for comparison. The thiocyanoacetates were also tested against eggs of *P. humanus* and against eggs and other stages of *Cimex lectularius*, L. From the results, which are shown in a table, it is deduced that esters of acids containing a substituted thiocyano radicle (SCN) are much more potent insecticides than the corresponding esters of acids containing substituted chlorine (Cl) or esters having no substituted group in the hydrocarbon radicle of the acid ; that insecticidal efficiency increases in the thiocyanoacetate series (excluding methyl thiocyanoacetate) with the increase of the molecular weight of the alcohol radicle, and increases in the α-thiocyanobutyrates to a maximum in pentyl α-thiocyanobutyrate and then decreases ; that in the majority of the cases investigated the insecticidal efficiency of the esters decreased somewhat as the molecular weight of the hydrocarbon radicle of the acid increased ; and that the insecticidal efficiency of allyl thiocyanoacetate and allyl α-thiocyanobutyrate differs little from that of the corresponding propyl esters.

Papers noticed by Title only.

Anduze (P. J.). **Fauna culicidiana de Venezuela. Descripción de dos especies nuevas (Diptera : Culicidae)** [four new records in addition to descriptions of two new species].—*Bol. Ent. venezol.* **1** no. 2 pp. 43–49, 2 figs. Caracas, 1942. (With a Summary in English.) [*Cf. R.A.E.*, B **30** 96.]

Dalmat (H. T.). **A new parasitic Fly** [*Cuterebra peromysci*] **(Cuterebridae) from the Northern White-footed Mouse** [*Peromyscus leucopus noveboracensis* in Iowa].—*J. N. Y. ent. Soc.* **50** no. 1 pp. 45–52, 4 pls. New York, N.Y., 1942.

Jellison (W. L.) & Good (N. E.). **Index to the Literature of Siphonaptera of North America.**—*Bull. nat. Inst. Hlth* no. 178, iv+ 193 pp., 18½ pp. refs. Washington, D.C., Supdt. Documents, 1942. Price 25 *cts.*

Grundmann (A. W.), Boles (H. P.) & Ackert (J. E.). **Plague Flea,** *Xenopsylla cheopis* [on rats] **in Kansas.**—*Trans. Kans. Acad. Sci.* **44** pp. 238–240, 10 refs. Manhattan, Kans., 1941. [*Cf. R.A.E.*, B **30** 34.]

MELLANBY (K.), JOHNSON (C. G.) & BARTLEY (W. C.). **The Treatment of Scabies.** —*Brit. med. J.* no. 4252 pp. 1–4, 10 refs. London, 1942.

Doubt is expressed as to the necessity for soaking and scrubbing the skin as a preliminary to treating a case of scabies [*Sarcoptes scabiei*, DeG.]. It is pointed out that the lesions produced in rodents by *Notoedres*, which was used in experiments that led Gordon & Seaton to suggest that scrubbing is important [*R.A.E.*, B **30** 118], are covered with scabs and dry exudate, whereas *S. scabiei* is seldom so protected. As new methods have often been advocated on the grounds that they are simpler than the old ones, tests were made with most of the treatments in common use to determine whether they would be effective under simpler conditions than those usually recommended. These experiments, which dealt with rotenone, pyrethrum, benzyl benzoate and sulphur preparations, including dimethyl thianthrene (dimethyl-diphenylene disulphide), in various forms and at various strengths, indicated that only sulphur ointment and benzyl benzoate are satisfactory, with the exception of dimethyl thianthrene, which is expensive in normal times and at present practically unobtainable. They also showed that the mite can usually be eradicated by the use of these substances without washing or scrubbing. Nevertheless, it is recommended that, before a chemical is applied, the body should be soaked in a hot bath and soaped well to assist penetration. The disappearance of symptoms, such as itching, is not a reliable indication of cure. The chief criterion adopted in the experiments was an examination of the adult female mites removed from treated cases. If any live mite is found 24 hours after treatment, a recurrence of the disease is likely. Preliminary experiments suggested that substances that kill ovigerous females are also reasonably effective against the eggs. Larvae, nymphs and adult males occur nearer the surface than females and are probably more easy to kill. As mortality in the developmental stages is very high, the chance of reinfestation occurring where some 5 per cent. of the eggs survive is exceedingly remote unless populations are abnormally large.

The effectiveness of sulphur ointment depends on the liberation of active products through the interaction of the sulphur and the human body ; *Sarcoptes* can survive for several days when stuck in sulphur ointment on a slide. Almost all the mites were killed by one application of 10 per cent. sulphur ointment at the rate of about 3 oz. per patient, and all were eradicated by two applications. It is the only treatment that can be satisfactorily applied by the patient himself. It is essential to cover the whole body except the head, but excessive quantities of the ointment should not be used or it may cause severe dermatitis. Benzyl benzoate was effective when applied at the rate of 3·5 fl. oz. of a 10 per cent. spirit solution or 2 fl. oz. of a 20 per cent. emulsion in water. Three methods of preparing such an emulsion are described.

COLEMAN (P. N.). **Scabies in an Army Unit.**—*Brit. med. J.* no. 4253 p. 40, 2 refs. London, 1942.

Data given on the cases of scabies [*Sarcoptes scabiei*, DeG.] occurring in an Army unit in Britain over a period of seven months suggest that the majority of the men concerned were infested from their homes while on leave. It would seem that blankets and clothes do not play a large part in transmission, and that fairly prolonged and intimate contact with another case is necessary to acquire the disease [*cf. R.A.E.*, B **29** 182].

KOMP (W. H. W.). **The Species of** *Nyssorhynchus* **confused under** *tarsimaculatus* **Goeldi, and a new Name,** *A. emilianus*, **for one Species found in Pará, Brazil (Diptera, Culicidae).**—*Ann. ent. Soc. Amer.* **34** no. 4 pp. 791–807, 8 figs., 22 refs. Columbus, Ohio, 1941.

The Anopheline formerly called *Anopheles tarsimaculatus*, Goeldi, is now known to comprise a complex of species [*cf. R.A.E.*, B **29** 177, 181, etc.]. A

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history of the development of knowledge of this complex is given. The life-history and ecology of a species collected at Belém, Pará, the type locality of the form to which Goeldi gave the name *tarsimaculatus*, were worked out, and the species was found to be distinct from *A. oswaldoi*, Peryassú, *A. nuñez-tovari*, Gabaldon, *A. rangeli*, Gabaldon, Cova-García & Lopez, and *A. aquasalis*, Curry ; it is described as *A. emilianus*, sp. n., from larvae collected in April 1941 in a grassy pool, pupae, adults of both sexes bred from such larvae, and eggs deposited by females taken on cattle and apparently identical with those that had been reared. The grounds for believing that this is Goeldi's species are given. Goeldi's name is shown to be invalid [**29** 181], and the claims of two other possible names, *evansi*, Brèthes [**14** 197] and *gorgasi*, D. & K., are rejected. The former is considered unrecognisable, and the latter, which was described from a single female in poor condition collected on the Pacific side of the Isthmus of Panama [**29** 181], should, the author believes, be referred to *albimanus*, Wied. The new species has hitherto been confused with *A. aquasalis*, but can be separated from it by certain differences. These are principally in the egg ; the male terminalia are not particularly distinctive, and the larvae of the two species are not separable and closely resemble those of *A. oswaldoi*.

Larvae of *A. emilianus* were very common in parts of the city of Belém and in its suburbs. They were found in various collections of grassy, sunlit fresh water. It is believed that the species may be widespread in the Amazon Valley and may also occur in British Guiana, breeding in irrigation ditches in the rice-fields, but *A. aquasalis* probably occurs in that region also. Nothing is known of the ability of *A. emilianus* to transmit malaria. It did not frequent houses in Belém even in the immediate neighbourhood of its breeding-places, and it preferred the blood of cattle to that of man.

Dias (E.), Brito Mello (G.), Costa (O.), Damasceno (R.) & Azevedo (M.). **Investigações sôbre esquisotripanose de morcegos no estado do Pará. Encontro do barbeiro *Cavernicola pilosa* como transmissor.** [Investigations on Trypanosomiasis in Bats in the State of Pará. The Triatomid, *C. pilosa*, as a Vector.]—*Rev. brasil. Biol.* **2** no. 1 pp. 103–110, 10 figs., 15 refs. Rio de Janeiro, 1942.

A list is given of 16 species of bats taken in the State of Pará, Brazil, of which 7 harboured trypanosomes ; the latter were of at least 3 types, resembling *Trypanosoma* (*Schizotrypanum*) *vespertilionis*, *T.* (*S.*) *phyllostomae* and *T.* (*S.*) *megadermae*, respectively. *Cavernicola pilosa*, Barber, was found in tree holes inhabited by bats, including examples of one of the species that were found infected ; 8 of 15 adults of this Triatomid contained flagellates. One nymph and three larvae were dissected with negative results. When 7 examples of *Triatoma brasiliensis*, Neiva, and 2 of *Rhodnius prolixus*, Stâl, were allowed to engorge on naturally infected bats of three species, the only infection observed was a few flagellates in one example of *T. brasiliensis*.

Ram (L. M.). **Malarial Survey of Stann Creek District with relevant Observations on the Incidence of Malaria in British Honduras.**—*J. trop. Med. Hyg.* **45** no. 3 pp. 18–24, 7 figs., 10 refs. London, 1942.

Data are given on the incidence of malaria in British Honduras, with particular reference to the Stann Creek District. They are preceded by brief notes on the climate, topography and population of the Colony. Most of the information that follows on the Anophelines found there has already been noticed [*R.A.E.*, B **30** 23]. Larvae of *Anopheles albimanus*, Wied., were found in temporary and permanent swamps, roadside, drainage and irrigation ditches, the margins of brackish creeks, rice-fields and roadside rain-water pools devoid of vegetation

in the middle of a town. They were most abundant in quiet pools with plenty of floating vegetation and exposed to the sun. They were not found in any rain-water storage receptacle during a house-to-house survey in Stann Creek in 1940 or in puddles in animal pens at the Government Agricultural Station. Larvae of *A. vestitipennis*, D. & K., were found in shaded pools along the clumps of coarse grass, shaded swamps and shaded roadside ditches. There seem to be different races or sub-species of both *A. darlingi*, Root, and *A. vestitipennis* in British Honduras, as *A. darlingi* was easily attracted to animal bait in Stann Creek Valley but was purely a house-haunting species in Toledo, while the reverse was true of *A. vestitipennis*. The chief public health problem for the district and town of Stann Creek is the control of *A. albimanus*.

UNTI (O.). **Anofelinos do Vale do Paraíba. Nova variedade e ciclo evolutivo do** *Anófeles* (*Nyssorynchus*) *Osvaldoi* **var.** *Ayrozai* **n. var.** [Anophelines of the Paraíba Valley. A new Variety, *ayrozai*, of *Anopheles oswaldoi*, and its developmental Cycle.]—*Ann. paulist. Med. Cirurg.* **40** no. 5 pp. 377–392, 1 fig., 12 refs. São Paulo, 1940. [Recd. 1942.]

Descriptions are given of all stages of *Anopheles oswaldoi*, Peryassú, var. *ayrozai*, n., from females caught by using a horse as bait, material bred from eggs laid by these females, and larvae collected in water with a pH of 6·4–7·0, in São Paulo, Brazil, together with characters distinguishing the eggs from those of the typical *A. oswaldoi* and vars. *noroestensis*, Galvão & Lane, and *metcalfi*, Galvão & Lane. The females of var. *ayrozai* seem to be strictly zoophilous; they were not taken by day or night in houses. Development from egg to adult required 22–33·5 days in summer at 22–30°C. [71·6–86°F.] and 42–46 days in water at 16–24°C. [60·8–75·2°F.].

UNTI (O.). **Anofelinos do Vale do Paraíba. Nota III. Biologia do** *Anófeles* (*Nyssorhynchus*) *strodei* **Root, 1926 com a descrição d'uma variedade nova.** *Anófeles* (*Nyssorhynchus*) *strodei ramosi* **var. n.** [Anophelines of the Paraíba Valley. Note III. Biology of *Anopheles strodei* and Description of a new Variety, *ramosi*.]—*Ann. paulist. Med. Cirurg.* **40** no. 6 pp. 489–505, 1 fig., 11 refs. São Paulo, 1940. [Recd. 1942.]

Anopheles (*Nyssorhynchus*) *strodei*, Root, var. *ramosi*, n., is described from larvae collected in São Paulo, Brazil, in marshes with turbid water rich in organic matter, covered with aquatic vegetation and with an acid reaction. The adults cannot be distinguished from those of the typical *A. strodei*.

Development of the typical form from egg to adult required 17–21 days in the laboratory in summer at 15–30°C. [59–86°F.] and 40–50 days in winter at 8–25°C. [46·4–77°F.]. The various samples of water used for breeding had a pH between 7·0 and 7·4 and a content of ammoniacal nitrogen that ranged from traces (too small to be measured) to 3·95 mg. per litre. No development occurred in fresh rain-water. The characteristics of the water in various natural breeding places are briefly discussed.

SERGENT (Et.). **Paludisme des oiseaux. Réceptivité des moustiques à l'infection du** *Plasmodium relictum*.—*Arch. Inst. Pasteur Algérie* **18** no. 2 pp. 214–215, 2 refs. Algiers, 1940. [Recd. 1942.]

In an experiment made to compare the susceptibility of Algerian individuals of *Culex pipiens*, L., and *Aëdes aegypti*, L., to infection with *Plasmodium relictum*, 104 out of 111 of the former developed 5,139 oöcysts, while only 6 out of 115 of the latter became infected and these contained only 9 oöcysts.

SERGENT (Et.). **De quelques caractères différentiels des larves d'*Anopheles maculipennis* var. *atroparvus* du Limousin et var. *labranchiae* du littoral algérois.**—*Arch. Inst. Pasteur Algérie* **18** no. 2 pp. 216-220, 2 figs., 3 refs. Algiers, 1940. [Recd. 1942.]

The differences in the form of the first hair of the second abdominal segment and the second hairs of the fourth and fifth abdominal segments in larvae of *A. maculipennis* vars. *atroparvus*, van Thiel, and *labranchiae*, Flni., on which identification of the larvae is based, are discussed in detail and shown to be very slight. They serve only as secondary differential characters. The two varieties are much more easily separated by examination of the eggs.

COLLIGNON (E.). **La campagne antipaludique de 1939 dans le département d'Alger.**—*Arch. Inst. Pasteur Algérie* **18** no. 2 pp. 221–236, 4 pls., 2 graphs, 1 ref. Algiers, 1940. [Recd. 1942.]

An account is given of the measures carried out in the campaign against Anophelines and malaria in the Department of Algiers in 1939 [*cf. R.A.E.*, B **28** 78], when there was an epidemic, caused principally by *Plasmodium falciparum*. This resulted from an exceptional abundance of Anophelines following abnormally heavy rainfall and a persistent reservoir of infection, and to a certain extent from an increase in susceptibility on account of the relatively low incidence of malaria in previous years. The results of the campaign were excellent, but the outbreak nevertheless showed that control operations must be extended and intensified.

SERGENT (Et.). **Essai de transmission de la theilériose bovine, par des anophèles.**—*Arch. Inst. Pasteur Algérie* **18** no. 2 p. 237. Algiers, 1940. [Recd. 1942.]

During 1938, 24 females of *Anopheles maculipennis* var. *labranchiae*, Flni., were allowed to feed on a bovine the blood of which contained gametes of *Theileria annulata* (*dispar*) capable of infecting ticks, and, after an interval of at least a month, on a healthy animal. The latter developed no symptoms of infection.

SERGENT (Et.). **Sur le *Demodex folliculorum* var. *hominis* dans le cérumen.**—*Arch. Inst. Pasteur Algérie* **18** no. 2 p. 238. Algiers, 1940. [Recd. 1942.]

Demodex folliculorum, Simon, was found in the cerumen of 30 out of 107 persons of various ages, races and classes and of both sexes, chosen at random in Algiers in November and December 1938. This mite is known to occur very frequently in the sebaceous glands and follicles of the down on the face.

SIEGFRIED (G.) & IZAC (R.). **Le paludisme dans l'Annexe de Laghouat.**—*Arch. Inst. Pasteur Algérie* **18** no. 3 pp. 279–294, 2 pls., 1 map, 7 refs. Algiers, 1940. [Recd. 1942.]

An account is given of the topography and climate of the Dependency of Laghuat which lies between 0°1′ W. and 2° E. longitude and 33 and 35° N. latitude. The population of Laghuat town and of the northern part of the Dependency is mainly settled, while that of the southern part is nomadic. The two groups come into close contact during the winter, when the nomads visit the town and villages. Malaria does not exist under normal conditions in the town of Laghuat, where Anophelines rarely occur as there is no water that could provide permanent breeding places. In the villages, the conditions with regard to potential breeding places in each of which are described, there is enough endemic malaria to give rise to short and severe epidemics when particularly

favourable conditions arise. An epidemic occurred in 1939 in a very small village on the outskirts of which larvae of *Anopheles hispaniola*, Theo., were found in a spring among fairly dense vegetation.

SERGENT (Et.). **A la différence de l'hôte vertébré, le** *Culex* **infecté de** *Plasmodium relictum* **n'acquiert pas la prémunition contre une réinfection par le même** *Plasmodium*.—*Arch. Inst. Pasteur Algérie* **18** no. 3 pp. 295–298, 1 pl., 3 refs. Algiers, 1940. [Recd. 1942.]

An account is given of experiments which showed that the presence of *Plasmodium relictum* in a mosquito does not make it immune from reinfection. In the first, 35 out of 37 individuals of *Culex pipiens*, L., allowed to feed twice at intervals of at least 16 days on canaries heavily infected with *P. relictum* were subsequently found to contain sporozoites as a result of the first meal and numerous immature oöcysts as a result of the second. A mosquito that received a second infective meal four months after the first one was also found not to be immune. A further experiment showed that females of *C. pipiens* could harbour simultaneously sporozoites, large immature oöcysts and young oöcysts of *P. relictum* acquired during three different meals taken, respectively, 33, 11 and 4 days before dissection.

CLASTRIER (J.). **Sur la présence d'***Anopheles plumbeus* **Stephens en Algérie.**—*Arch. Inst. Pasteur Algérie* **18** no. 3 p. 299. Algiers, 1940. [Recd. 1942.]

Larvae of *Anopheles plumbeus*, Steph., which had not previously been recorded from Algeria, were found near Algiers in water in a hollow cork oak at an altitude of about 2,600 ft. in May 1940. There was a mass of vegetable débris and the remains of a few Arthropods in the tree hole, and the water in it contained 2·35 gm. tannin per litre.

PARROT (L.) & MARTIN (R.). **Notes sur les phlébotomes. XXXII. Sur** *Phlebotomus* (*Prophlebotomus*) *subtilis*.—*Arch. Inst. Pasteur Algérie* **18** no. 3 pp. 300–304, 4 figs., 6 refs. Algiers, 1940. [Recd. 1942.]

PARROT (L.). **Notes sur les phlébotomes. XXXIII. Présence de** *Phlebotomus ariasi* **Tonnoir dans la banlieue d'Alger.**—*T.c.* pp. 305–306, 13 refs. **XXXIV. Les " épines géniculées " des phlébotomes.**—*T.c.* pp. 307–320, 6 figs., 10 refs.

In a previous note [*R.A.E.*, B **24** 160], a female *Phlebotomus* found at Diredawa, Abyssinia, was provisionally identified as *P. tiberiadis*, Adl. & Thdr., although it differed slightly from those of that species. A description of it was given. Similar females were later found in another part of Abyssinia in association with *P. subtilis*, Parrot & Martin, the female of which was unknown [**27** 234]. Examination of a collection of *Phlebotomus* made between September 1939 and March 1940 at Jibuti, French Somaliland, and comprising 379 males of *P. subtilis*, 81 females identical with those found at Diredawa and a pair in copula showed that the females taken in Abyssinia were those of *P. subtilis*. The description of the male of *P. subtilis* and that of the female are accordingly republished here with additions and minor corrections. Features distinguishing both sexes from *P. tiberiadis* are given.

In the second paper, it is recorded that a batch of sandflies, taken at the end of June 1940 in a kennel at Kouba, near Algiers, included a male and two females of *P. ariasi*, Tonn. The ducts of the spermathecae of the females agreed exactly with the description given in 1934 [**23** 43]. This record brings up to five the number of species of *Phlebotomus* known to occur in the town or suburbs of Algiers. *P. ariasi* is known to occur in southern France, Spain and Algeria.

The third paper deals with an examination of the available Old World species and varieties of *Phlebotomus* as a result of which it was determined that the antennal formula (number of geniculated spines on an antennal segment and the numbers of the segments on which they occur) together with the form and relative length of the spines, particularly those of the fourth segment, are in certain cases at least, secondary characters useful in classification and specific identification.

SENEVET (G.) & ABONNENC (E.). **Les moustiques de la Guyane française. VI. Les anophélinés. 2.—Le sous-genre** *Stethomyia*.—*Arch. Inst. Pasteur Algérie* **18** no. 4 pp. 441–442, 1 fig., 1 ref. Algiers, 1940. [Recd. 1942.]

A number of Anophelines taken on the walls of a building at Cayenne between 16th June and 20th August 1940, and thought at first to be *Anopheles nimbus*, Theo., included six males, and it was possible to identify these by a study of the hypopygium as *A. acanthotorynus*, Komp [*R.A.E.*, B **25** 255]. This record considerably extends the known distribution of *A. acanthotorynus*, which is in consequence thought probably to occur over the whole of tropical South America. It is also the first time that a species of the subgenus *Stethomyia* has been recorded from French Guiana.

SENEVET (G.) & CHABELARD (R.). **A propos des nymphes d'anophélinés. Cinquième mémoire.**—*Arch. Inst. Pasteur Algérie* **18** no. 4 pp. 443–447, 3 figs. Algiers, 1940. [Recd. 1942.]

In this fifth paper of a series [*cf. R.A.E.*, B **22** 140], new diagrams are given of the ventral hairs of the Anopheline pupae of the subgenera *Anopheles*, *Myzomyia* and *Kerteszia* on the one hand and *Nyssorhynchus* on the other, together with modifications of the general pupal characters of these subgenera as previously published [*loc. cit.*].

SERGENT (Et.). **Tritons adultes et larves de moustiques.**—*Arch. Inst. Pasteur Algérie* **18** no. 4 pp. 458–460, 1 fig., 2 refs. Algiers, 1940. [Recd. 1942.]

Larval newts are known to feed on mosquito larvae [*R.A.E.*, B **11** 172] and are of value in malaria control. It has now been observed that adults of *Euproctus poireti*, a newt that occurs fairly commonly on the Algerian coast, also feed on mosquito larvae. One adult in captivity consumed 3,775 larvae of *Theobaldia longiareolata*, Macq., 11 mm. long, out of 4,070 available in 61 nights, 985 larvae of *Culex pipiens*, L., 9 mm. long, out of 1,075 available in 11 nights, 840 larvae of *C. pipiens*, 7 mm. long, out of 1,013 available in 13 nights and 176 larvae of *Anopheles maculipennis* var. *labranchiae*, Flni., 7 mm. long, out of 470 available in 11 nights. During 7 nights on which 140 larvae of *T. longiareolata* 11 mm. long and 140 of *C. pipiens* 9 mm. long were exposed together, the newt ate all the larvae of *T. longiareolata* and 113 of the larvae of *C. pipiens*. When 120 larvae of *C. pipiens* and 120 of *A. maculipennis* var. *labranchiae* of the same size were exposed together for 6 nights, 100 of the former and 53 of the latter were consumed. It is thought, therefore, that the newt preferred the larger larvae and perceived the *Culex* larvae more readily than the Anopheline larvae because of the oblique position and greater mobility of the former. Adult newts are thus beneficial, but less so than the larval stages, which consume Anophelines and Culicines indiscriminately.

SERGENT (Et.). **Sur l'action culicifuge de certains produits.**—*Arch. Inst. Pasteur Algérie* **18** no. 4 pp. 461–463, 1 ref. Algiers, 1940. [Recd. 1942.]

In experiments to determine the value as mosquito repellents of a mixture of 6 parts oil of eucalyptus, 3 parts oil of citronella and 1 part naphthalene, which

is stated to be commonly used against lice, and an extract of the leaves of *Melia azedarach*, which is used against locusts [*R.A.E.*, A **26** 180], 2,332 adults of *Aëdes aegypti*, L., *Anopheles maculipennis* var. *labranchiae*, Flni., and *Culex pipiens*, L., were used. Of these, 1,175 bit twice. A hand was exposed for five minutes to mosquitos that had been kept without food for several days and was withdrawn before they could engorge. It was then smeared with the product to be tested and exposed for a further five minutes to the mosquitos after varying intervals. The numbers of mosquitos that bit on the first and second occasions were compared. The effect of each of the components of the mixture on each species of mosquito was analogous with that of the mixture itself. The latter began to lose its repellent effect to *Aëdes aegypti* after about 30 minutes and had lost it completely at the end of 90 minutes. The repellent effect to *A. m. labranchiae* began to decrease after one hour but was still apparent after four, while that to *C. pipiens* began to decrease in some instances after 30 minutes but in others was still apparent after nine hours. The effect of the extract of *M. azedarach* was so weak that it is considered to offer no promise as a mosquito repellent.

WEYER (F.). **Blutnahrung und Eiproduktion bei** *Anopheles maculipennis* **und** *Anopheles superpictus*. [Blood-meals and Egg Production in *A. maculipennis* and *A. superpictus*.]—*Zbl. Bakt.* (I. Orig.) **147** pp. 342–350. Jena, 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 5–6 p. 127. Paris, 1942.)

A comparative study was made of the number of blood meals required for egg production by Anophelines in nature and in the laboratory. Females of *Anopheles maculipennis* var. *atroparvus*, van Thiel, during their period of activity oviposit after a single blood meal, even if they have been in the laboratory for a long time. The females of *A. maculipennis* var. *messeae*, Flni., behave in the same way in nature. During hibernation, several meals are necessary, especially during November and December. Some reared females of *A. superpictus*, Grassi, need 13–66 blood-meals before oviposition ; the average requirement of this species is 3–4 meals. The behaviour of *A. maculipennis* var. *labranchiae*, Flni., is intermediate. The fact that *A. superpictus* may bite many times before developing eggs renders it particularly likely to transmit malaria.

WEYER (F.). **Die Einrichtung einer Dauerzucht von** *Anopheles superpictus* **in Hamburg (mit biologischen Beobachtungen).** [Arrangements for con tinuous Breeding of *A. superpictus* in Hamburg (with biological Observations.)]—*Zbl. Bakt.* (I. Orig.) **147** pp. 454–470. Jena, 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 5–6 p. 127. Paris, 1942.)

A strain of *Anopheles superpictus*, Grassi, obtained from Albania, was maintained for three years at Hamburg. By 1st February 1941, 33 generations had been reared. The larvae were fed on hay infusions. The species is stenogamic, and the adults paired in a cubic cage with sides 35 cm. long. The temperature was maintained at 25–30°C. [77–86°F.], and activity in the laboratory appeared to be continuous. The females fed readily on man or rabbits and sometimes on fowls. They would feed every day, and the deposition of one batch of eggs necessitated an average of 3–5 blood meals. The durations of the various stages are given in a table.

BRUMPT (E.). **Les entomophthorées parasites des moustiques.**—*Ann. Parasit. hum. comp.* **18** no. 1–3 pp. 112–144. Paris, 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 5–6 p. 129. Paris, 1942.)

On vats filled with macerated leaves and serving as artificial breeding places for mosquitos in central France, 105 individuals of *Culex pipiens*, L., and a

female of *Theobaldia annulata*, Schr., were found infested and killed by *Entomophthora conglomerata*. The various kinds of Entomophthoraceae found to infest mosquitos are reviewed and shown to comprise 6 species. Of numerous attempts at artificial infestation of adults and larvae, only one was successful. The mosquito concerned was an adult of *C. pipiens*, reared from a larva fed on crushed bodies of infested mosquitos. The author emphasises the unreliable nature of the results obtained when Entomophthoraceae are used as a means of controlling mosquitos and their other insect hosts.

ROUBAUD (E.) & TREILLARD (M.). **L'asséchement des étangs de la Brenne et l'antipaludisme.**—*Bull. Soc. Path. exot.* **34** p. 97. Paris, 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 5–6 pp. 129–130. Paris, 1942.)

The Brenne district in central France was formerly very malarious. It was partly drained in 1860, but most of the dried ponds were later refilled. However, local malaria continued to decrease and eventually disappeared. A comparative study of the occurrence of Anophelines was made in November 1939 near the ponds that are still dry and near those that are full and used for rearing fish. The site of 10 ponds drained in 1860 was found to form a vast grassy and marshy depression much more favourable to Anopheline breeding than the sheets of water of the full and well maintained ponds. Many individuals of *Anopheles maculipennis* var. *atroparvus*, van Thiel, were found in farm buildings about 160 yards from the site of some of the dried ponds, while the Anopheline density near ponds in which fish are now being kept was much lower. The form near the ponds was *A. maculipennis* var. *messeae*, Fln.

SCHWETZ (J.). **Sur les gîtes larvaires d'***A. pharoensis* **Theo. et** *A. squamosus* **au Congo Belge.**—*Bull. Soc. Path. exot.* **34** pp. 153–158. Paris, 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 5–6 p. 131. Paris, 1942.)

Only very occasional individuals of *Anopheles pharoensis*, Theo., have been recorded from the Belgian Congo, but the author found hundreds of larvae of this species and a few of *A. squamosus*, Theo., among algae (*Ceratophyllum demersum*) in Lake Kivu where a volcanic eruption had altered the character of the vegetation. Larvae of *A. pharoensis* were also found on Lake Albert among aquatic plants including *Ceratophyllum demersum*, together with those of *A. funestus*, Giles, and *A. symesi*, Edw. It is suggested that the attractiveness of *Ceratophyllum* for *A. pharoensis* may be analogous to that of *Pistia stratiotes* for *Mansonia*, though *A. pharoensis* has been found in very different breeding places. *A. squamosus* seems to be often associated with it, but is rarer.

SAUTET (J.). **L'anophélisme en Syrie et au Liban dans ses rapports avec le paludisme.**—*Bull. Mus. Hist. nat. Marseille* **1** pp. 106–129, 2 pls., 3 folders. Marseilles, 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 5–6 pp. 131–132. Paris, 1942.)

A complete list of the Anophelines found in Syria and the Lebanon is drawn up from a study made by the author in 1940 and from previous records. *Anopheles sergenti*, Theo., *A. superpictus*, Grassi, *A. pharoensis*, Theo., *A. algeriensis*, Theo., and *A. maculipennis*, Mg., probably var. *sacharovi*, Favr (*elutus*, Edw.), had already been recorded from the Sanjak of Alexandretta. *A. m. sacharovi*, *A. superpictus* and *A. hyrcanus*, Pall., were found in Syria by the author and previous workers, and in addition, *A. sergenti*, *A. multicolor*, Camb., *A. algeriensis* and *A. claviger*, Mg. (*bifurcatus*, auct.) occurred in the Lebanon [*cf.* also next abstract]. The fauna of the Alaouite territory was the same. *A. claviger*

is the only vector of malaria in the southern Lebanon. *A. m. sacharovi* is the most dangerous everywhere else, followed by *A. superpictus* and finally *A. sergenti* and *A. multicolor*.

A. maculipennis var. *sacharovi* here develops exclusively in fresh water, and *A. sergenti* and *A. superpictus* chiefly in running, pebbly water. *A. multicolor* occurs in brackish water, *A. hyrcanus* and *A. algeriensis* in marshes and *A. claviger* in cisterns and open-air rural breeding places. *A. maculipennis* var. *sacharovi* is the most domestic species, followed by *A. sergenti* and *A. superpictus*; *A. multicolor* also enters houses. *A. sergenti* predominates in autumn, *A. algeriensis* in winter, *A. hyrcanus* in spring and *A. superpictus* and *A. m. sacharovi* in summer and autumn.

LEESON (H. S.). **The Occurrence of *Anopheles marteri* in Syria.**—*Bull. ent. Res.* **33** pt. 1 pp. 35–37, 5 refs. London, 1942.

Anopheles marteri, Sen. & Prun., was first found in Syria in the larval stage on 30th August 1941; larvae and adults were taken there on several occasions between this date and 11th October. Reference is made to papers in which the various stages are described, and descriptions are here given of all stages as they occur in Syria, that of the egg being quoted from Hadjinicolaou [*R.A.E.*, B **26** 159], who recorded it from Greece. Some characters by which larvae, pupae and adults of *A. marteri* may be distinguished from those of *A. algeriensis*, Theo., and *A. claviger*, Mg., are tabulated. The breeding places of *A. marteri* in Syria, which were of the same type as those described in Greece [*loc. cit.*] and North Africa [**16** 189], were shaded pools in steep and rocky stream-beds, situated at altitudes varying from 400 to 4,000 ft. The paper concludes with keys to the adults and larvae of the seven species of *Anopheles* now known to occur in Syria. These comprise *A. marteri* and the species recorded from Syria and the Lebanon in the preceding abstract, with the exception of *A. multicolor*, Camb.

AITKEN (T. H. G.). **The *Anopheles* Complex in California (Diptera, Culicidae).**—*Proc. 6th Pacif. Sci. Congr. 1939* **4** pp. 463–486, 4 figs., 4 pp. refs. Berkeley, Calif., 1941.

The investigations that have led to the recognition in Europe of various races of *Anopheles maculipennis*, Mg., that differ in their habits and relation to malaria are briefly reviewed as an introduction to a detailed account of an investigation carried out to ascertain whether similar varieties occur in the Anophelines of California. The species recorded in that State are *A. punctipennis*, Say, *A. pseudopunctipennis*, Theo., and *A. maculipennis*. Their distribution is reviewed. *A. punctipennis*, which is widely distributed from southern Canada to Mexico, is scattered throughout central and northern California. It breeds in cool, clear pools in the beds of wooded creeks that are drying up. These pools often contain green algae. Adults were found throughout the winter near the coast, and there were indications that breeding continues throughout the year. No Anopheline breeding places were found in a tour through the northern San Joaquin Valley in the middle of December, and hibernating adults of all three species with immature ovaries and well developed fat-body were collected in a number of places. No marked variations were found in the eggs of *A. punctipennis* apart from 9 abnormal specimens in one batch of 150. Oviposition records in the laboratory indicated an average of slightly more than 200 eggs per female. One female was observed to oviposit four times, the batches consisting of 166, 145, 154 and 35 eggs, respectively. The adult does not readily enter houses in California, and its importance as a vector of malaria is considered slight, though numerous references are made to papers in which it has been shown to be susceptible to *Plasmodium vivax* and *P. falciparum*.

A. pseudopunctipennis occurs over the western regions of North, Central and South America between 32°S. and 42°N. latitude. It is widely distributed in California, being absent only from the north-eastern counties and the south-eastern desert regions, and it reaches its greatest development in the south and along the coast. It breeds in pools of receding rivers too warm for *A. maculipennis* or *A. punctipennis*, usually among algae, but occasionally in clear pools devoid of vegetation. Its breeding habits are more or less similar throughout its range, but the feeding habits and resting places of the adults appear to differ markedly in various regions. There is evidence in the literature that it is a domestic species in South America and Mexico and that it is an efficient vector of malaria in a number of countries in South and Central America; it shows very little preference for dwellings in the United States and is considered to be of little or no importance in malaria transmission there. The data on the male terminalia are confusing, as the phallosome is sometimes stated to be with, and sometimes without, leaflets. Outside the United States, the leaflets are usually present, while in California the form with leaflets was of wide occurrence, but there was also a good deal of material without them. Occasionally, both types of terminalia were present in mosquitos from the same locality. The leaflets were usually extremely delicate and sometimes very hard to discern. Only the material from San Diego County had leaflets comparable with specimens from Morelos, Mexico, and Costa Rica. One specimen available from Tennessee had very distinct leaflets. Two types of eggs have been described, typical eggs in a paper by Herms and Frost [*R.A.E.*, B **20** 220] and atypical eggs in one by Herms and Freeborn [**9** 66]. Both types have been found in California at all times of the year, as well as egg batches in which the eggs ranged from the typical to the atypical. There is evidence that the atypical eggs are associated with the males in which the phallosome bears leaflets, though in a locality in which both types of eggs are present, the male progeny from atypical eggs may be of either form. In view of these facts, the author is inclined to the view that *A. pseudopunctipennis* is a complex [*cf.* **29** 172, 173], the northern race being *franciscanus*, McCracken, and that *pseudopunctipennis* proper (or perhaps a close "variety") also extends up into California and interbreeds with *franciscanus*.

Evidence is produced to show that *A. maculipennis* is represented by three forms in North America [**28** 122], *occidentalis*, D. & K., which has a pale, silvery mark on the apical wing fringe, and *freeborni*, Aitken, and *aztecus*, Hffm., which have no such marks and thus resemble *A. quadrimaculatus*, Say. All three are distinguished by the eggs. *A. m. occidentalis* occurs along a narrow coastal strip of California northwards into Canada and Alaska and along the international boundary to New England, *A. m. freeborni* is found throughout the interior of all the western States, but reaches the coast only in southern California, and *A. m. aztecus* occurs in central Mexico. A list of all the localities from which *A. m. occidentalis* is known to the author is given in an appendix. *A. m. freeborni* is the most important of the three as a vector of malaria. *A. m. aztecus* may transmit the disease in the Valley of Mexico, but *A. m. occidentalis* is not known to be a vector.

VARGAS (L.). **El problema de las variedades de *A. punctipennis*. Descripción de *A. punctipennis stonei* n. var. (Diptera. Culicidae.)** [The Problem of the Varieties of *Anopheles punctipennis*. Description of *A. punctipennis* var. n. *stonei*.]—*Rev. Soc. mex. Hist. nat.* **2** no. 2–3 pp. 175–186, 4 figs., 23 refs. Mexico, D. F., 1941.

From an examination of material from Canada, the United States and Mexico, and of specimens in the United States National Museum, the author considers that *Anopheles punctipennis*, Say, is represented by at least three varieties. These are the typical form, which occurs in Canada and the United States, var.

perplexens, Ludl., which was considered a synonym of it, and of which the only available specimen is a badly preserved female from Pennsylvania, and var. *stonei*, n., both sexes of which were obtained from Mexico and the United States and the male from Ottawa, Canada. Descriptions are given of the adults of the new variety, based on examples from Nuevo León, Mexico, and of the typical form from Washington, D.C., together with characters of the terminalia distinguishing the males. Characters are quoted from the original description distinguishing var. *perplexens* from the typical form.

Hinman (E. H.) & Hurlbut (H. S.). **A Collection of Anopheline Mosquitoes from southern Ontario.**—*Canad. Ent.* **74** no. 1 p. 20. Guelph, Ont., 1942.

Adult mosquitos collected in August 1940 in and near the basement of a farmhouse in southern Ontario were found to include both sexes of *Anopheles quadrimaculatus*, Say, and *A. punctipennis*, Say. Larvae found in large numbers in flood water from a river flowing about a quarter of a mile from the house included *A. quadrimaculatus*, *A. punctipennis* and *A. walkeri*, Theo. Previous records of *A. quadrimaculatus* in Canada are reviewed.

Gregson (J. D.). **The Coast Tick (*Ixodes californicus* Banks) Problem in British Columbia.**—*Canad. Ent.* **74** no. 1 pp. 3–5, 2 refs. Guelph, Ont., 1942.
Host Poisoning by *Ixodes californicus* Banks (Acarina, Ixodidae).—*Proc. ent. Soc. B. C.* no. 38 pp. 5–6. Vernon, B.C., 1942.

In the first paper, an account is given of the importance of *Ixodes ricinus californicus*, Banks, as a pest of man and domestic animals in British Columbia, which has increased considerably during recent years on account of the spread of human settlement into the regions inhabited by it and a resulting marked increase in its numbers. It appears to be distributed over most of the southern coastal region of the Province, including Vancouver Island, but is exceptionally abundant only in certain areas. It is a three-host tick. The larvae and nymphs feed chiefly on lizards, and only a few of large numbers of other animals examined were found to harbour them. The animals from which they were obtained included squirrels, white-footed mice [*Peromyscus*] and grouse. So far as is known, the adults attack only large animals ; they are common on dogs, cats, deer, goats, cattle and man. Large numbers of dogs and cats in an infested region produce ideal conditions for the increase of the tick. There are indications that in West Vancouver, thousands of larvae hatch in the immediate vicinity of many houses, and there are abundant lizards in the gardens and underbrush about any dwelling almost throughout the year. The ticks are more numerous during the wet winter months than in summer and autumn, and reach maximum activity in spring, when 20–25 are sometimes removed each day from individual dogs. The males feed only briefly on their hosts and cause temporary irritation, but the wound inflicted by the female is more painful and may result in severe toxaemia ; the lesion may take the form of an extended swelling that often lasts for several days or a slow-healing ulcer that in exceptional cases persists for 18 months.

The effects of the bites of the females are discussed in more detail in the second paper. It is emphasised that the ulcers are too severe and persist too long to be accounted for by the presence of the mouth-parts of the tick in the wound and that healing must be delayed largely by the toxic irritant. An oedema similar to that produced in man occurs in guineapigs fed on by adult ticks. Larvae and nymphs are also shown to be toxic to these animals. The larval progeny of a single tick usually killed an adult guineapig within five days of the infestation, while as few as 70 nymphs killed one though they succeeded in engorging only partly before it died. Inoculations of the crushed ticks and the blood of the dead animals into fresh guineapigs failed to produce any abnormal symptoms.

In spite of the marked susceptibility of guineapigs to the toxin of *I. r. californicus*, there are indications that an immunity is built up in the survivors of initial infestations.

SPENCER (G. J.). **Two unusual larval Habitats of Tabanids (Diptera).**—*Proc. ent. Soc. B. C.* no. 38 pp. 10–12, 3 refs. Vernon, B.C., 1942.

A newly formed puparium from which a perfect adult of *Tabanus punctifer*, O.-S., emerged on 1st July 1937 was found a month earlier under a small stone on the dry and heavily overgrazed range north of Kamloops, British Columbia, at an altitude of 3,250 ft., and some 150 ft. above and 200 yards from the surface of a lake. In all records of the larval habitats of Tabanids known to the author, the larvae are stated to be aquatic or semi-aquatic. It is, however, considered extremely unlikely that this larva had developed on the shore of the lake and crawled up the dry hillside to pupate. The soil under the stone was less dry than that of the surroundings, but Tabanid larvae are reported to be predacious, and it is doubtful whether this one found enough insects under the stone to support it to maturity. It is, therefore, concluded that it must have wandered about in the very dry soil round it. On another occasion, two newly emerged adults of *T. punctifer* were taken on a fence, about 50 yards up a 60° dry, gravelly slope above a small range pool.

A larva that gave rise to an adult thought to belong to an undescribed species of *Hybomitra* was found buried to a depth of two inches in wet sand uncovered by an exceptionally low tide at Coal Harbour, Vancouver. It was kept in sea water for three days and pupated in damp sand. This is thought to be the first record of the larva of a marine Tabanid developing at a point on the sea shore covered by sea water except at low tide. The chlorinity of the water was high, so that the larva needed, or was adapted to, real marine conditions.

GREGSON (J. D.). **Host Immunity to Ticks (Acarina).**—*Proc. ent. Soc. B. C.* no. 38 pp. 12–13, 3 refs. Vernon, B.C., 1942.

In view of recent papers on acquired immunity from ticks [*R.A.E.*, B **27** 172, 199; **28** 144], a brief report is made of preliminary experiments carried out in the autumn of 1936 at Kamloops, British Columbia, to determine whether there was any foundation for the opinion held by ranchers that locally-bred animals develop immunity from ticks and whether an immunity that would retard or inhibit the feeding of nymphs could be induced experimentally in laboratory animals. One of two comparable guineapigs was given four weekly subcutaneous injections with 2 cc. of an emulsion of 20 half-engorged nymphs of *Dermacentor andersoni*, Stiles, that had just been removed from another guineapig. No reaction followed. During the fifth week, both guineapigs were subjected to equal infestations of nymphs. One tick engorged on the treated guineapig and 11 on the control. At the end of the experiment, precipitation tests were made with serum from each animal, but the emulsion failed to give any precipitate. In a more recent experiment, polecats developed a marked immunity from a second infestation by *Ixodes texanus*, Banks, within about 10 days of the first.

WAGNER (O.). **Experimentelle Untersuchungen über Ostküstenfieber an einheimischen Rindern.** [Experimental Investigations on African Coast Fever in German Cattle.]—*Dtsch. tropenmed. Z.* **45** no. 4 pp. 97–102. Hamburg, 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 7–8 p. 176. Paris, 1942.)

African Coast Fever, the causal organism of which is *Theileria parva*, was transmitted to young bovines at Frankfort by the bites of infected nymphs of

Rhipicephalus appendiculatus, Neum., from South Africa. The nymphs were infective after fasting for 6 months, but not after fasting for 12, although they were still quite active.

ULLYETT (G. C.). & DE VRIES (A. H.). *Bembix* **Wasps as Enemies of Sheep Blow-flies.**—*Fmg in S. Afr.* **16** no. 178 pp. 19–20. Pretoria, 1941.

A sudden decrease in the numbers of sheep blowflies at the end of January in the Karroo areas of South Africa, was found to be associated with the presence of wasps of the genus *Bembix*, which carry away adult flies while the latter are on the wing. Flies of at least 7 families may be attacked, but blowflies have been found to consitute 80 per cent. of the prey when they are abundant. Field and laboratory observations showed that the nests of the wasps are at the ends of burrows extending 6–9 ins. into the moist sand of river-beds and banks, so that their distribution is limited by the availability of such breeding places. A single egg is deposited on a paralysed fly in the nest, and the larva, which hatches after one or two days, is provided with food by the female. It consumes 50–60 flies in 4–5 days and pupates in a cocoon of silk and sand. Each female makes a separate nest, and only one larva occupies each nest, but it is not known whether more than one nest is attended by a female at one time, nor how many larvae a female can rear in succession. It is thought improbable that this number exceeds 5 or 6. The wasps appear in the field at the end of October and become abundant in December. Successive generations develop until March. During dull or cold weather, the wasps remain in their burrows. There are few natural enemies of *Bembix*, but excessively heavy rain may result in the pupae being drowned, or washed to the surface of the sand and exposed to desiccation. On the other hand, moderate rainfall is necessary to maintain the humidity of the breeding grounds. *Bembix* wasps certainly reduce blowfly populations, but, on account of the limitation of suitable nesting sites and the failure of the wasps to capture many blowflies unless the latter are prevalent, it is concluded that their action cannot be usefully given artificial aid.

SHEW (W. D.). **The Foot or Leg Louse of Sheep.**—*J. Dep. Agric. Vict.* **40** pt. 1 p. 15, 1 fig. Melbourne, 1942.

As sheep infested by *Linognathus pedalis*, Osb., have recently been found in various markets in Victoria, very brief notes are given on the appearance of this louse, the parts of the leg that it usually infests and its control [*cf. R.A.E.*, B **26** 252]. Two treatments at intervals of 10–14 days with a recognised sheep dip containing derris or rotenone are recommended. The sheep should stand in the bath for 5 minutes. Complete immersion is unnecessary unless there is evidence of the presence of lice on the head or body. Oviposition begins when the lice are about 12 days old, and the eggs hatch in 10–18 days.

HERRICK (G. W.). **Chicken Lice and Mites and their Control.**—*Cornell Ext. Bull.* no. 115 (revd.) 18 pp., 8 figs., 10 refs. Ithaca, N.Y., N.Y. St. Coll. Agric., 1940. [Recd. 1942.]

This bulletin deals chiefly with the habits and control of the lice and mites that infest poultry in New York, but includes a brief note on *Ceratophyllus gallinae*, Schr., which has only occasionally been recorded in the United States, but readily attacks man as well as fowls, in the nests of which it breeds. The egg, larval and pupal stages of this flea last about 7–10, 10–14 and 10–21 days, respectively.

SMART (J.). **Lice.**—*Econ. Ser. Brit. Mus.* (*Nat. Hist.*) no. 2A, 32 pp., 3 figs., 18 refs. London, 1942. Price 6*d*.

Notes are given on the morphology and bionomics of the three kinds of Anoplura that occur on man (*Pediculus humanus*, L., its race *capitis*, DeG., and *Phthirus pubis*, L.), the types of situations and habits that promote the dissemination of lice, the diseases transmitted by *Pediculus humanus*, and the prevention and eradication of infestations, including various methods of controlling the lice on the person and of treating clothes.

FRIEDMANN (M.). **Notes on Human Lice.**—*Indian med. Gaz.* **77** no. 3 pp. 146–148, 4 refs. Calcutta, 1942.

It is pointed out that as *Pediculus humanus*, L. (*vestimenti*, Nitzsch) lays its eggs on the hairs of the body as well as on the clothes, treatment will not be effective if it is confined to disinfection of the clothes but must deal with the hairs also. Methods of treatment are discussed.

WOOD (S. F.). **Reactions of Man to the Feeding of Reduviid Bugs.**—*J. Parasit.* **28** no. 1 pp. 43–49, 7 refs. Lancaster, Pa., 1942.

Observations on the physical effects of allowing Triatomids to feed at different times on various parts of the author's arm, hand or fingers are described in detail. No marked discomfort was experienced in the course of the feeding of any of the bugs, which comprised most of the species of *Triatoma* recently collected in the south-western United States [*R.A.E.*, B **29** 191, 192] and *Paratriatoma hirsuta*, Barber. No marked reactions followed the bites of any species of *Triatoma*, but a continuous slight local irritation at the site of the bites of *P. hirsuta* set in after 40 hours. It had decreased 12 hours later. There was no general reaction of any kind.

SWARTZWELDER (J. C.) & CALI (S. J.). **Human Intestinal Myiasis due to Syrphid Larvae. Report of an additional Case** (*Eristalis tenax*).—*Amer. J. trop. Med.* **22** no. 2 pp. 159–163, 2 figs., 13 refs. Baltimore, Md., 1942.

Only 21 cases of human myiasis involving Syrphid larvae are known to have been recorded in the literature. In all except one of these, the site of the infestation was the gastrointestinal tract. A report is here made of a similar infestation that occurred in a white girl in Louisiana in 1940. There was a history of attacks of pain usually followed by vomiting. On one occasion, a larva was coughed up, and seven more were expelled following the administration of an anthelmintic. They were identified as a species of *Eristalis*, probably *E. tenax*, L. The child's symptoms are described, but as chronic bronchitis was also present, it is not known how many of them, if any, are attributable to the myiasis.

CROS (A.). *Blatta orientalis* **et ses parasites. I.** *Evania punctata* **Brullé ; II.** *Eulophus* **sp. Etude biologique.**—*Eos* **18** pt. 1 pp. 45–67, 1 pl. Madrid, 1942.

An account is given of observations on *Blatta orientalis*, L., and its egg-parasites at Mascara, Algeria, in 1939–41. The egg parasites were *Evania punctata*, Brullé, and a Eulophid thought to belong to the genus *Eulophus*. The cockroaches became adult in June and July, and the females oviposited from June to the end of October, but a few survived from June to December. Males did not live so long. Eggs laid up to early August hatched after 45–60 days,

and those laid later hibernated. The nymphal stage lasted about two years, with periods of retarded development and slight activity from the end of autumn to the end of the following spring.

Evania punctata was found in places infested by the cockroach, and had at least two generations a year, the adults of which emerged in June–July and September–October. The females searched the ground for buried egg-capsules. Only one adult emerged from a single capsule. In the case of the Eulophid, up to 130 adults emerged from individual capsules. In 1941, four generations were observed; adults of the first, from hibernated eggs, appeared early in summer, and the others developed in from 30 to 60–70 days in summer and autumn. Adult life lasted 4–5 days, except that in the fourth generation it was 10–12 days. In view of its high potential rate of increase, this parasite might be bred for release in places infested by *B. orientalis*.

ROSENFELD (G.) & CARDOSO (F. A.). **Distribuição dos triatomideos e da moléstia de Chagas no estado de São Paulo (Brasil).** [Distribution of Triatomids and Chagas' Disease in São Paulo.]—*Rev. clin. S. Paulo* **9** no. 6 pp. 198 209, 2 maps, 31 refs. 1941. (With a Summary in English.) (Abstr. in *Trop. Dis. Bull.* **39** no. 4 p. 247. London, 1942.)

A brief review of the literature on the occurrence of Chagas' disease in São Paulo is followed by a list of the vectors found infected in nature, together with a map of the State showing the municipalities or counties in which no Triatomids were seen, in which only uninfected ones were found and in which infected ones were present. The species found were *Triatoma infestans*, Klug, which was the commonest, *T. rubrofasciata*, DeG., *T.* (*Eutriatoma*) *oswaldoi*, Neiva & Pinto, *T.* (*E.*) *sordida*, Stål, *T.* (*E.*) *tibiamaculata*, Pinto, *Panstrongylus megistus*, Burm., *P. geniculatus*, Latr., and *Rhodnius domesticus*, Neiva & Pinto. The distribution of Triatomids, of human cases of the disease and of animals found infected in nature is shown on a second map. Triatomids were found in 92 of 270 municipalities investigated, and examples from 41 of them were proved to be infected with *Trypanosoma cruzi*. Eleven human cases were found in seven municipalities, and three infected domestic dogs in two.

PIFANO (F.). **Parasitismo natural de *Amblyomma longyrostre* Koch, 1844 por *Schizotrypanum cruzi* Chagas, 1909.**—*Gac. méd. Caracas* **48** no. 10 pp. 288–289. 1941. (Abstr. in *Trop. Dis. Bull.* **39** no. 4 p. 247. London, 1942.)

In the course of an examination of the ectoparasites of arboreal porcupines of the State of Yaracuy, Venezuela, *Amblyomma longirostre*, Koch, was found naturally infected with *Trypanosoma* (*Schizotrypanum*) *cruzi*. The larval and nymphal stages of this tick are commonly passed on birds, but the adults are more usually seen on tree-dwelling mammals.

TANAKA (S.). **Untersuchungen der hygienischen Gegenstände in der Yulin-Gegend auf der Insel Hainan.** [Investigations on Health Conditions in the Yulin District of Hainan.] [*In Japanese.*]—*J. med. Ass. Formosa* **40** no. 7 pp. 1181–1211, 1 pl., 53 refs. 1941. (With a Summary in German.) (Abstr. in *Trop. Dis. Bull.* **39** no. 4 p. 251. London, 1942.)

The Yulin district of Hainan, where malaria is endemic, is crossed by many streams from the foothills, and a sluggish river with thickly wooded banks flows through it. The mean temperature varies from 24·5 to 28·6°C. [76·1 to 83·48°F.] and the relative humidity is over 50 per cent. There is a season of heavy rain. The Anophelines found there comprised 132 individuals of *Anopheles hyrcanus* var. *sinensis*, Wied., 101 of *A. jeyporiensis* var. *candidiensis*,

Koidz., 23 of *A. maculatus*, Theo., and 78 of *A. annularis*, Wulp. Malaria parasites, *Plasmodium vivax* and *P. falciparum* in about equal proportions, were found in 6·1 per cent. of the persons examined. Enlarged spleens were found in 34·3 per cent. of the total and in 64·2–75 per cent. of the children under 15.

Marshall (J. F.). **Mosquito-breeding in Static Water Supplies.**—*Nature* **149** no. 3786 pp. 568–570, 10 refs. London, 1942.

In view of a general fear that the large open air tanks of water established by the fire-fighting authorities in urban areas throughout Great Britain might lead to greatly increased mosquito breeding, the justification for these misgivings is examined and the extent to which precautionary measures can and should be adopted is discussed. It is emphasised that water should on no account be treated unless mosquitos are known to be present as not only is it a waste of time and money but it destroys the natural enemies of the larvae. Moreover, oil is extremely injurious to tanks with bituminous linings. Until recently, it was thought that the only mosquitos likely to breed in the tanks and reservoirs were *Culex pipiens pipiens*, L., and *Theobaldia annulata*, Schr., of which the former breeds in either clean or foul water and the latter chiefly in water contaminated by nitrogenous matter. *T. annulata* attacks man avidly, but *C. p. pipiens* rarely does, so that it was considered improbable that mosquitos likely to cause annoyance would breed in the tanks unless the water was allowed to become contaminated. This is probably true of open-air containers, but as *C. pipiens molestus*, Forsk., which occurs in Britain, particularly in London and coast towns [*R.A.E.*, B **27** 55, etc.], is stenogamic and autogenous [**25** 136; **28** 191, etc.] and can breed underground throughout the year [**29** 18–19], it is felt that this mosquito, which attacks man very fiercely whenever opportunity occurs, may extend its range by breeding in water allowed to stand in basements and other underground situations. Should this occur, the covering of ventilators, window openings, etc., to prevent gravid females from reaching the water might be advisable.

Papers noticed by Title only.

Pereira Barretto (M.) & Coutinho (J. O.) **Contribuição ao conhecimento dos flebótomos de São Paulo. IV. Descrição de tres novas espécies.** [Contribution to the Knowledge of the *Phlebotomus* of São Paulo. Description of three new Species (*Phebotomus pestanai*, *P. cardosoi* and *P. mangabeirai*, all from males).]—*Papéis avulsos Dep. Zool.* **1** pp. 143–158, 3 pls., 9 refs. São Paulo, 1941. **V. Descrição do macho de** *P. monticolus* **Costa Lima 1932 e de duas novas espécies.** [Description of the Male of *P. monticolus* Costa Lima and of two new Species (*P. castroi* and *P. lanei*, both from males).]—*T.c.* pp. 177–191, 3 pls., 16 refs. **VI. Descrição de duas novas espécies (Diptera, Psychodidae).** [Description of two new Species (*P. oliverioi* from a male, and *P. bourrouli* from both sexes).]—*T.c.* pp. 223–233, 3 pls., 14 refs. (With Summaries in English.) [*Cf. R.A.E.*, B **30** 128.]

Gillett (J. D.). **A Larvascope for Use in Identification of living Culicine Larvae.**—*Bull. ent. Res.* **33** pt. 1 pp. 27–29, 1 fig. London, 1942.

Hassall (A.), Doss (M. A.), Taylor (R. M.), Carson (G. B.) & Segal (D. B.). **Index-catalogue of Medical and Veterinary Zoology. Part 6. Authors: G to Gyser.**—pp. 1459–1754. Washington, D.C., U.S. Dep. Agric., 1942. Price 40 *cts.* (from Supt. Documents). [*Cf. R.A.E.*, B **29** 184.]

PENFOUND (W. T.). **The Relation of Plants to Malaria Control with special Reference to impounded Waters.**—*Publ. Hlth Rep.* **57** no. 8 pp. 261–268, 3 refs. Washington, D.C., 1942.

The relation of vegetation to the breeding of Anopheline vectors of malaria, particularly in impounded water, was the subject of investigations carried out during the summers of 1937–40, inclusive, by the Tennessee Valley Authority in and near their reservoirs [where the vector is *Anopheles quadrimaculatus*, Say]. The findings are discussed from the points of view of the preparation and maintenance of reservoirs. It has been observed that certain trees just above normal pool level are killed by the increased depth of water in newly impounded reservoirs. As a result of an investigation made between 1937 and 1939, trees were classed as tolerant, moderately tolerant and intolerant according to the length of time they could survive in shallow water. The members of the intolerant class usually succumb in less than two months. Since dead trees or their parts constitute a mosquito hazard when they fall into the reservoir, it is recommended that all intolerant species be removed for some distance above the maximum summertime pool level, but no clearing of trees of the other classes is necessary above this level. A list of local trees in order of decreasing tolerance is given. Investigations on growth from the stumps showed that only stumps less than 12 ins. in diameter produced sprouts, and that the growth rate, which averaged 0·33 in. per day, was greatest in the tolerant group. A knowledge of these facts and of the dates on which growth began and ended and the period when it was greatest made it possible to forecast the height of the shoots just before closure and to time recutting so as to prevent the production of favourable breeding conditions after impounding. Methods of treating stumps by poisoning are discussed.

The maintenance of a clean water surface in the second and subsequent seasons after the formation of a reservoir is rendered difficult by the growth of shoots on the stumps and colonisation by aquatic plants. Although stumps do not produce shoots when submerged, many do so abundantly when uncovered as late as the middle of the growing season. As the stumps of intolerant trees do not sprout when they are inundated for extended periods and as the deeper the water the fewer and smaller the sprouts, it is suggested that trees should be cut as close to the ground as possible. Recutting was found to decrease the rate of growth by 25 per cent., but it never eliminated sprouting completely. Grazing animals along the shore line reduced large areas of sprouts to vanishing point. Aquatic and semi-aquatic plants are much more important in relation to mosquito breeding than shoots from stumps. Lists are given of locally important species, some of which colonise new reservoirs with great rapidity. The effect of fluctuation in the water level or the recession of the water from certain areas at some seasons is discussed. In general, fluctuation is detrimental to the submerged species but not to others. Seasonal recession eliminates all submerged species from the dried zone, but emergent species extend further into the lake each year until the maximum area is covered, and land species invade the dried zone, but are killed when the water rises again. Herbaceous plants are at present controlled by removal, recurrent cutting or herbicides, notes on which are given.

REEVES (W. C.), HAMMON (W. McD.) & IZUMI (E. M.). **Experimental Transmission of St. Louis Encephalitis Virus by *Culex pipiens* Linnaeus.**—*Proc. Soc. exp. Biol.* **50** no. 1 pp. 125–128, 11 refs. New York, N.Y., 1942.

It is pointed out in a brief review of the literature that though epidemiological investigations suggest that the virus of St. Louis encephalitis is transmitted by mosquitos in the United States, and Mitamura and his associates have reported its transmission by *Culex pipiens* var. *pallens*, Coq. [*cf. R.A.E.*, B **29** 194],

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American workers have failed to obtain transmission by mosquitos [*cf.* **29** 127]. R. J. Blattner & F. M. Heys have recently shown that it is transmitted experimentally by *Dermacentor variabilis*, Say, but there is no epidemiological evidence implicating ticks as vectors. The usual laboratory animals fail to develop a fatal encephalitis following subcutaneous inoculation of such a dose of virus as might be expected from a mosquito bite, and this possibly explains some of the negative results with mosquitos. For this reason, the authors used special methods in the experiments here described, including isolation of the virus from the brain or blood during the course of the inapparent infection, and virus neutralisation tests on a preliminary and post-experimental serum specimen.

The experiments were carried out with females of *Culex pipiens*, L., collected as adults and infected by feeding on a 10 per cent. brain suspension of the virus in 5 per cent. sheep serum infusion broth mixed with equal parts of whole defibrinated rabbit blood. All the mosquitos that fed on a cotton pad soaked in this suspension and sprinkled with sugar were kept at 23–27°C. [73·4–80·6°F.]. Positive results were obtained in three out of four experiments. In two of them, mosquitos fed repeatedly (30 and 111 times, respectively), starting 5 days after being infected, on pigeons with blood free from antibodies. Fifteen days after the last feed, each of the two pigeons had a high titre of serum neutralising antibody. A control pigeon kept with them did not develop protective antibodies. In the third successful experiment, 100 mosquitos were allowed to feed on doves and on mice less than 8 days old. Virus was isolated from the blood of one dove 24 hours after the mosquitos fed, and from the brain of one mouse. Antibodies developed in the serum of 3 of the doves and not in the control. The negative experiment was carried out with similar mice, but there were only 25 mosquito feedings and no virus was demonstrated in the mosquitos. In all the experiments, mosquitos were removed at intervals of from 3 to 18 days after the infective meal and virus was isolated at 3, 6, 7, 9, 12, 13 and 15 days. The only sample tested after 18 days was negative.

Pereira Barretto (M.). **Observações sobre a biologia do *Phlebotomus whitmani* Antunes e Coutinho, 1939 (Diptera, Psychodidae) em condições experimentais.** —*Papéis avulsos Dep. Zool.* **1** pp. 87–99, 8 refs. São Paulo, 1941. (With a Summary in English.)

An account is given of the bionomics of *Phlebotomus whitmani*, Antunes & Coutinho, bred from females captured in nature in Brazil, some of the results of which were referred to in a paper already noticed [*R.A.E.*, B **30** 93]. The technique was the same as that used for *P. intermedius*, Lutz & Neiva [*cf.* **30** 129]. Under the most favourable conditions, which were a temperature of 25–27°C. [77–80·6°F.] and a nearly saturated atmosphere, the egg, larval and pupal stages were completed in minimum periods of 7, 19, and 8 days, respectively. Development was retarded at lower temperatures, and the percentage mortality increased at higher ones until at 30°C. [86°F.] no eggs hatched after exposure for 24 hours, and the larvae died. Three females laid 24, 29 and 42 eggs, respectively. Apart from retarded development due to low temperature, a diapause of 96–203 days occurred in some of the fourth-instar larvae.

Smart (J.). **Notes on Simuliidae (Diptera).**—*Proc. R. ent. Soc. Lond.* (B) **11** pt. 3 pp. 46–50, 1 fig., 8 refs. London, 1942.

This paper includes additional notes on some of the species of *Simulium* recorded in a previous one on the Simuliids of British Guiana, the Lesser Antilles and neighbouring countries [*R.A.E.*, B **28** 208]. The characters of the type specimens of *S. amazonicum*, Goeldi, and *S. tarsale*, Will., which have

recently been discovered in the British Museum, are discussed, and *S. clavipes*, Mall. [**2** 168], which was omitted from the previous paper, is considered a synonym of *S. tarsale*.

FAIRCHILD (G. B.). **The Seasonal Distribution of some Tabanidae (Dipt.) in Panama.**—*Ann. ent. Soc. Amer.* **35** no. 1 pp. 85–91, 1 pl., 15 refs. Columbus, Ohio, 1942.

Data on the seasonal activity of Tabanids reviewed from the literature indicate that the majority of species are single-brooded and that each has a fairly definite flight season, which may be very short. An account is given of an investigation undertaken to see whether this generalisation applied to the Tabanids of Panama. Collections were made about every two weeks from March 1940 until March 1941. The position of the station where the collections were made and its climate are briefly described. The 11,997 flies taken represented 35 species, a list of which is given. The most abundant were *Tabanus lineola* var. *carneus*, Bell., and *T. maya*, Beq., which constituted 49·1 and 12·5 per cent. of the total, respectively. The seasonal abundance of 14 of the more common or characteristic species is shown in a graph. They fall roughly into three groups : those without a definite flight season, those with a flight season corresponding in the main to either the dry or the rainy period, and those with a very short and definite season occurring in either period. Only two species showed indications of having two distinct broods ; it is not known whether this was due to the production of two generations in the year or to the existence of two separate broods with an annual cycle. *T. l. carneus* was almost uniformly abundant throughout the year. Some comparisons are made between the author's results and those obtained in other localities, and it is suggested that types of seasonal distribution are to some extent related to taxonomic groupings. Very few Tabanids were taken between 8 a.m. and 4 p.m., and it is estimated that quite 60 per cent. of the species are crepuscular.

VANDERPLANK (F. L.). **A Note on Trypanosomiasis of Game from Tsetse Areas at Shinyanga and Ukerewe Peninsula.**—*Trans. R. Soc. trop. Med. Hyg.* **35** no. 6 pp. 319–322, 2 refs. London, 1942.

Detailed results are given in a table of an examination of 135 wild animals for trypanosomes between June 1939 and September 1941 at Shinyanga (Tanganyika Territory), where *Glossina swynnertoni*, Aust., and *G. pallidipes*, Aust., are present, and the Ukerewe peninsula,where only *G. swynnertoni* occurs. Of the total number of animals, 22·2 per cent. were positive, and 0·7, 20 and 3·7 per cent. showed *Trypanosoma brucei*, *T. congolense* and *T. vivax*, respectively, a few animals having mixed infections. Of 45 impala (*Aepyceros melampus*), 21 giraffe and 19 wart-hog (*Phacochoerus aethiopicus*), 20, 47·6 and 15·8 per cent., respectively, were infected [*cf. R.A.E.*, B **30** 6]. The numbers of the 18 other species examined were too small to admit of comparison. The percentages of infection among adult animals and animals less than 1 year old were 21·9 and 36·8, respectively, but it is not known whether the difference is significant. Evidence is also adduced indicating that infection is higher during the rains than during the dry season. It is considered probable that all wild animals except monkeys, rodents and small insectivores become infected with trypanosomes while young and that their natural resistance overcomes the infection, but that relapses may occur when they become wet and cold in the heavy rains.

SULLIVAN (W. N.), GOODHUE (L. D.) & FALES (J. H.). **Toxicity to adult Mosquitoes of Aerosols produced by spraying Solutions of Insecticides in liquefied Gas.**—*J. econ. Ent.* **35** no. 1 pp. 48–51, 1 graph, 7 refs. Menasha, Wis., 1942.

In view of the large power required and the danger of fire when an aerosol for killing adult mosquitos in a confined space is produced by spraying an

alcoholic solution of pyrethrins on to a hot plate [*R.A.E.*, B **28** 239-240], tests were made of a method that seems more practicable for use in houses and particularly in aeroplanes. It consists in applying the insecticide in the form of an aerosol produced by allowing a solution in a liquified gas to be sprayed under its own pressure into the atmosphere. Upon release, the solvent evaporates rapidly and leaves the insecticide as a colloidal dispersion. The insecticide used was pyrethrum oleoresin containing 14·8 per cent. pyrethrin I and 12·7 per cent. pyrethrin II, with the addition of refined sesame oil as an activator, and the solvent was liquid dichlorodifluoromethane refined for use as a refrigerant. The equipment consisted of a tank designed to retain highly volatile liquids, a valve and a nozzle that would produce a fine mist when the solution was ejected under pressure. The solution was prepared by mixing 32 gm. pyrethrum oleoresin and 20 gm. sesame oil with 20 cc. chloroform and filtering the mixture into an evacuated supply tank. The chloroform was then withdrawn by evaporation, and the supply tank was inverted over and connected with the tank containing the liquid solvent. This tank was placed in ice water to make the pressure lower than that in the supply tank. The valves were then opened, the liquid insecticide was rapidly run into the cold tank, the tanks were closed and disconnected, and the nozzle was attached to the one containing the insecticide. The contents, which were shaken to produce a uniform solution, weighed 2,160 gm. To produce the aerosol, the tank was inverted and the valve opened.

The effectiveness of the method was determined in tests on males and females of *Culex pipiens*, L., fed on sugar solution and females of *Aëdes aegypti*, L., *Anopheles punctipennis*, Say, and *A. walkeri*, Theo., some of which had also had a blood meal. The solution was sprayed into the room at the rate of 100 gm. per 1,000 cu. ft. and a fan aided its rapid distribution. Some of the mosquitos were exposed (in screen cages) for 5 minutes, and some for 10. After 48 hours there was complete mortality in all tests. In tests against *C. pipiens* with a solution in which the concentration of pyrethrins was reduced by more than a quarter, one mosquito out of 2,616 survived exposure for 5 minutes, and none survived a longer exposure. A satisfactory knockdown varying between 95 and 100 per cent. was also produced. In preliminary tests, the aerosol gave high kill of bedbugs [*Cimex lectularius*, L.] and an almost complete kill of cockroaches, at twice the dosage necessary to give complete kill of mosquitos. The aerosol was persistent, and much of it was visible after six hours. No ill effect was seen in 30 rabbits that were in the room during the test. The same method with the dosage used for the mosquitos gave complete knockdown of species of *Lyperosia* (*Haematobia*), *Stomoxys* and *Musca* in dairy barns in 10 minutes, and satisfactory control; no mortality counts were made. Spraying from a distance of 2 ft. did not injure or stain fabrics. The material is not inflammable and has no disagreeable odour. Many other insecticides could be applied by this method and other solvents used.

KNIPLING (E. F.). **Acquired Resistance to Phenothiazine by Larvae of the Primary Screwworm.**—*J. econ. Ent.* **35** no. 1 pp. 63–64, 7 refs. Menasha, Wis., 1942.

As phenothiazine [thiodiphenylamine] had been found in experiments to vary in its toxicity to larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), *Lucilia sericata*, Mg., and *L. cuprina*, Wied., studies were undertaken to determine to what extent the variation was due to individual resistance of the larvae and to ascertain whether such resistance is inherited. The experiments were made on a strain selected from the "regular stock" of *C. hominivorax* which has been reared for several years on a synthetic medium [*R.A.E.*, B **29** 132]. About 75 larvae that had survived a concentration of 0·1 per cent. phenothiazine in the breeding medium for 3 days were placed on untreated medium and reared to maturity, and the survivors, about 5 per cent. of those

placed on the medium, constituted the original special resistant strain. The technique used in the subsequent toxicity tests was that described by Bushland [**29** 83]. Thirteen generations of the resistant strain were reared; the larvae of nine of them were exposed for 3 days to media containing the same or a higher concentration of phenothiazine and the survivors were reared to maturity, and four intervening generations were carried through on untreated meat to increase the stock. The F_1 generation showed slightly greater resistance than the regular strain with which comparisons were made. In the five subsequent generations all exposed to 0·1 per cent. phenothiazine, the numbers surviving were 3–5 times that surviving in the regular strain.

The fifth generation of the special strain did not show increased tolerance to diphenylamine or diphenylene oxide. With the eleventh and subsequent generations, the tolerance of the two strains to various concentrations of phenothiazine up to 0·666 per cent. was tested. The results showed conclusively that larvae repeatedly reared on media containing toxic concentrations of this chemical had a greater tolerance to it than similar larvae reared on untreated media. The total number of survivors for the resistant strain was about 18 times that for the regular strain.

DEONIER (C. C.). **Seasonal Abundance and Distribution of certain Blowflies in southern Arizona and their economic Importance.**—*J. econ. Ent.* **35** no. 1 pp. 65–70, 3 refs. Menasha, Wis., 1942.

The following is substantially the author's summary. *Cochliomyia macellaria*, F., *Phormia regina*, Mg., and *Lucilia* spp., especially *L. sericata*, Mg., frequently cause heavy losses to the livestock industry of Arizona. They infest particularly the wounds in cattle caused by dehorning and soiled wool in sheep. Irrigated valleys in southern Arizona, with their high animal populations, were found to be favourable to *Lucilia* in the spring. *P. regina* was present in large numbers during the spring in both the irrigated and the unirrigated valleys. *C. macellaria* became the dominant species during the summer and autumn. The seasonal and local abundance of *C. macellaria*, *P. regina* and *Lucilia* spp. was determined by the use of conical fly traps in different localities in the State. The number of flies of each kind taken in traps in 1937 and 1938 in four localities in the south, representing various ecological types, is shown by months, together with data on temperatures and precipitation. In wounds in 120 sheep infested by blowfly larvae, *C. hominivorax*, Coq. (*americana*, Cush. & Patt.), *L. sericata*, *P. regina* and *C. macellaria* were involved in 105, 26, 16 and 15 cases and were in pure culture in 80, 7, 4 and 2 cases, respectively, and *Sarcophaga* was concerned in one case. The species involved in seven cases was not determined.

PARISH (H. E.) & KNIPLING (E. F.). **Field Studies of certain Benzene Derivatives as Larvicides and Wound Protectors against the Screwworm.**—*J. econ. Ent.* **35** no. 1 pp. 70–73, 4 refs. Menasha, Wis., 1942.

Following the testing in the laboratory of a large number of chemicals as larvicides for the control of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) [*R.A.E.*, B **29** 83], field tests to compare the effectiveness of diphenylamine and other organic chemicals with that of pine-tar oil in protecting wounds from reinfestation were carried out in central Texas in 1938. As a result, diphenylamine was recommended for use in place of pine-tar oil, which did not give protection to so many wounds or for so long [**28** 237; **29** 137]. In 1939, further tests were carried out on infested sheep, goats, cattle, pigs and horses with diphenylene oxide, *p*-nitrophenetole and a mixture of 95 per cent. diphenylamine and 5 per cent. calcium stearate, diphenylamine being used as the control. The wounds were first treated with benzene to kill the larvae, the soiled wool or hair was clipped around the wound and the powder to be tested was then

applied by hand. Diphenylamine gave the most effective protection, but caked on exposure to very high temperatures. The addition of calcium stearate prevented this to a great extent, but decreased the effectiveness of the diphenylamine by impairing its adhesive quality. In addition to being less effective than diphenylamine, *p*-nitrophenetole was too costly for practical use. Diphenylene oxide was less effective than diphenylamine in preventing reinfestations, but there was very little difference between them in duration of protection or healing time, and diphenylene oxide may become cheaper than diphenylamine and does not cake. Treatment was repeated on animals that became reinfested. In all cases, the number of days for which protection was afforded was smaller following the second and subsequent treatments than following the first. There was no evidence that deaths among the animals were attributable to poisoning by the chemical applied.

Griswold (G. H.). **An unusual Experience with** *Lucilia sericata*.—*J. econ. Ent.* **35** no. 1 p. 73. Menasha, Wis., 1942.

About 100 fly larvae dropped from a crack in the paper on the ceiling of a bedroom with screened windows at Ithaca, New York, in the course of a week in late September 1941, and some of them, kept on damp sand and fed on raw liver, gave rise to adults of *Lucilia sericata*, Mg. A few days later, 37 undersized adults of the same species not more than half as large as the reared ones were taken in the room, including one caught just as it was emerging from the crack. It is considered probable that the larvae were feeding on a mouse or squirrel that had died in the space between the ceiling and the floor of the room above.

Roark (R. C.). **Definition of Aerosol.**—*J. econ. Ent.* **35** no. 1 pp. 105–106, 7 refs. Menasha, Wis., 1942.

Recently described methods of dispersing non-volatile insecticides in the air or of enhancing the efficacy of fumigants of low volatility [*cf. R.A.E.*, B **29** 174; **30** 70, 111, etc.] involve dispersing a liquid or solid in the air in colloidal form, thus creating a mist or a smoke, and these suspensions in air have been known for nearly 20 years as aerosols. It is pointed out that in 1940, the United States Patent Office granted a trade-mark covering the use of the word Aerosol for a proprietary wetting agent, but there should be no confusion regarding the two uses of the word.

Laake (E. W.). **Dry Application of Cube or Derris in Combination with Wettable Sulfur for the Control of Cattle Grubs.**—*J. econ. Ent.* **35** no. 1 p. 112. Menasha, Wis., 1942.

Recent experiments in the United States showed that a dust composed of equal parts by weight of finely ground cubé or derris containing 5 per cent. rotenone and wettable sulphur applied dry to the backs of cattle from a can with a perforated lid at the rate of 1 lb. for 12–18 animals and gently rubbed into the hair was as effective in controlling cattle grubs [*Hypoderma*] as a wash or spray and simpler to apply. The method has found much favour with owners of small herds. The cost is discussed.

Wells (R. W.). **The Use of Power Sprayers in the Control of Cattle Grubs.**—*J. econ. Ent.* **35** no. 1 pp. 112–113. Menasha, Wis., 1942.

A method of applying suspensions of derris or cubé to the backs of cattle against larvae of *Hypoderma lineatum*, Vill., by means of a power sprayer and regular orchard gun with a pressure of about 250 lb. was devised during experiments carried out in the United States during 1940–41. The cattle were

restrained in a cattle chute and the spray was directed vertically downward to their backs from a nozzle held about 15 ins. away and opened so that the spray left it with stinging force. If the stream is adjusted to a diameter of about $2\frac{1}{2}$ ins. where it strikes the animal, it can penetrate the coat and dislodge the crusts at the openings of the lesions and thus obviate the necessity for scrubbing and effect a very large saving in labour. A bench was placed beside the chute for the operator to walk on. With an output of 2 U.S. gals. per minute, an animal could be effectively sprayed in 15 seconds, and it is estimated that with adequate equipment, 1,000 cattle can be treated in a day with one nozzle ; the method is thus particularly desirable for use in large herds. There appeared to be no advantage in using a concentration greater than 5 lb. cubé or derris powder containing 5 per cent. rotenone and 10 lb. wettable sulphur in 100 U.S. gals. water [*cf. R.A.E.*, B **30** 10, 131] so that there is some saving in material as well as labour. Wettable sulphur used instead of soap in washes against *Hypoderma* has the advantage that it carries a detergent effective in hard as well as soft water.

VARGAS (L.). **Nota sobre el papel de algunos artrópodos en la transmisión de** *Onchocerca volvulus*. [A Note on the Rôle of some Arthropods in the Transmission of *O. volvulus*.]—*Rev. Inst. Salub. Enferm. trop.* **2** no. 3–4 pp. 365–373, 19 refs. Mexico, D.F., 1941. (With a Summary in English.)

In laboratory experiments in Mexico, the author dissected various Arthropods $\frac{1}{2}$–4 hours after causing them to feed on patients that showed microfilariae of *Onchocerca volvulus* [of which he considers *O. caecutiens* to be a synonym] in the skin. Microfilariae were observed in 1 of 55 examples of *Cimex lectularius*, L., 2 of 24 of *Triatoma picturata*, Usinger, 2 of 49 of *Pediculus humanus*, L. (*corporis*, DeG.), 1 of 23 of *P. h. capitis*, DeG., and 12 of 27 of *Ornithodoros turicata*, Dugès, but none occurred in *Pulex irritans*, L., *Ctenocephalides canis*, Curt., *Aëdes aegypti*, L., or *Anopheles pseudopunctipennis*, Theo. The author considers that the tearing mouth-parts of *Simulium*, *Culicoides* and ticks render them capable of becoming infected with the microfilariae, but that ticks can be excluded as vectors. The possible rôle of *Culicoides* in this respect should be investigated.

VARGAS (L.). **Algunas consideraciones sobre el desarrollo de** *Onchocerca volvulus* **en los simúlidos.** [Considerations on the Development of *O. volvulus* in Simuliids.]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 1 pp. 57–64, 14 figs., 9 refs. Mexico, D.F., 1942. (With a Summary in English.)

The author considers that much of the information that exists with respect to the development in Simuliids of *Onchocerca volvulus*, of which he considers *O. caecutiens* a synonym, is incorrect. He reviews the literature on the subject, discusses in particular the views of C. C. Hoffmann [*cf. R.A.E.*, B **18** 213] and concludes that all the microfilariae in the mid-gut are digested and that only those in the diverticulum reach the thoracic muscles and the labium of the fly. Illustrations are given of thoracic sections of *Simulium callidum*, Dyar & Shannon, *S. ochraceum*, Wlk., and *S. metallicum*, Bellardi [*cf.* **23** 172, etc.], showing in the case of *S. callidum* the microfilariae *in situ*, and of *Culicoides filariferus*, Hffm. [*cf.* **28** 106]. Of 75 examples of *S. callidum* taken in Chiapas, all were infected.

VARGAS (L.). **Las hembras americanas del subgénero** *Anopheles* **(Dipt., Culicidae,** *Anopheles*). [The American Females of the Subgenus *Anopheles*.]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 1 pp. 67–74, 15 refs. Mexico, D.F., 1942. (With a Summary in English.)

The author gives a list showing the type species of each of the American subgenera of the genus *Anopheles* and of the series *Arribalzagia* and *Cycloleppteron*

of the subgenus *Anopheles*, a key to these subgenera, characters distinguishing the series *Anopheles*, *Arribalzagia* and *Cycloleppteron*, and keys to the females of the species of these series.

VARGAS (L.). **Nota sobre la presencia de** *Anopheles neomaculipalpus* **en México.** [A Note on the Occurrence of *A. neomaculipalpus* in Mexico.]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 1 pp. 75–79, 8 refs. Mexico, D.F., 1942. (With a Summary in English.)

Anopheles neomaculipalpus, Curry, is recorded for the first time from Mexico, where larvae were taken in the State of Chiapas and adults of both sexes in Veracruz. Lists are given of the species of *Anopheles* that occur in these States, together with a key to the adults of *A. neomaculipalpus* and four related species. It has been experimentally infected with malaria [*cf. R.A.E.*, B **24** 295] and has previously been recorded from Trinidad, Panama, Venezuela and Costa Rica. Its breeding places are briefly reviewed from the literature [*cf. loc. cit.*].

ROBERTSON jr. (J. L.), LEPRINCE (J. A.), JOHNSON (H. A.) & PARKER (W. V.). **Observations on experimental Malaria Control Drainage Ditch Linings.**—*Publ. Hlth Rep.* **57** no. 13 pp. 451–463, 8 pls., 5 refs. Washington, D.C., 1942.

A detailed account is given of experiments carried out in Tennessee on the effectiveness of monolithic concrete, brick, and precast concrete slabs as materials for lining drainage ditches in order to prevent Anophelines from breeding in them at the lowest possible construction and maintenance cost. It is concluded that monolithic slabs should be at least 2–2½ ins. thick to prevent cracking. Control of cracking by constructing dummy or false transverse joints to half the thickness of the lining appeared to be practicable. Light reinforcement apparently offered but slight advantage over plain, monolithic construction. Several types of precast concrete slab linings were tried, and functioned with a minimum of failures. Vegetation grew between butt joint slabs, but not between slabs held together by tongue and groove, interlocking or over-lapping joints. If bricks are used they should be hard and durable, and the workmanship must be good and adequate weep holes provided. A large part of the efficiency of the experimentally lined ditches is attributed to the stabilisation of the banks by means of Bermuda grass sod.

SHORTT (H. E.), MENON (K. P.) & SEETHARAMA IYER (P. V.). **The natural Host of** *Plasmodium gallinaceum* **(Brumpt, 1935).**—*J. Malar. Inst. India* **4** no. 2 pp. 175–178, 4 refs. Calcutta, 1941.

Some 40 individuals of the South Indian jungle fowl (*Gallus sonneratii*) collected around Madras were examined in an attempt to discover the natural host of *Plasmodium gallinaceum*, which is transmitted by various species of *Aëdes* [*R.A.E.*, B **24** 297 ; **25** 121 ; **27** 176], including *A. vittatus*, Big. Only one of the birds was found to be carrying a *Plasmodium*. Morphology and cross immunity and cross agglutination tests indicated that it was *P. gallinaceum*.

RUSSELL (P. F.) & KNIPE (F. W.). **Malaria Control by Spray-killing adult Mosquitoes. Third Season's Results.**—*J. Malar. Inst. India* **4** no. 2 pp. 181–197, 2 pls., 3 refs. Calcutta, 1941.

The effectiveness in the control of malaria in villages in southern India of spraying against the adult Anophelines with a mixture of kerosene and pyrethrum extract [*R.A.E.*, B **28** 92 ; **29** 153] was confirmed by a third season's

work in 1940 in the same and other villages. Much of the work was devoted to the development of improved types of equipment. Paint spray-guns [**28** 93] operated by hand-pumped air tanks or by power-filled air tanks were used. The hand-operated equipment is cheap, simple in operation and light in weight and can be sturdy, but the work is lengthy and exhausting. The power-filled tank saves time, but the equipment is expensive, labour experienced in the operation of a petrol-driven machine is required and transport is sometimes difficult. Solidified carbon dioxide for supplying pressure [**30** 83] is too expensive. The ordinary hand-operated "flit-gun" is poorly constructed and wastes the insecticide. Costs were studied from a number of view-points. Based on the pre-war price of materials, the costs per head of the population in the village in which spraying has now been carried out for three years were considerably lowered during the 1940 season. The only change made in this village was in equipment, hand-operated pressure tanks being substituted for "flit-guns." In one village, a reduced number of applications was tried, but the effect on control is not yet clear. In another, a home-made extract of pyrethrum was used. It was prepared by soaking 1 lb. chopped flowers in ½ gal. kerosene in an air-tight container for 48 hours with occasional shaking, decanting the liquor, resoaking the flowers in ¼ gal. kerosene for 24 hours, again decanting the liquor, placing the flowers in a funnel and allowing ¼ gal. kerosene to drip slowly through, and finally pressing the residue and mixing the liquid collected with the other three lots. The extract when mixed with an equal amount of kerosene appeared to be as lethal as Pyrocide 20 and kerosene (1 : 19) which was used in all the other tests, and cost about half as much. Comparison of the estimated costs per head of the population in 1940 for these villages and another in which equipment was tested [*cf.* **29** 153] with those for the village treated in 1939 indicates that there has been considerable progress in making the treatment economically practicable for villages in southern India. Some effect on the density of adults of *Anopheles culicifacies*, Giles, was noted. The largest number collected in the village sprayed in the three years was 16·1 per man-hour in June and the largest in an untreated village was 24·8 in August. There was no clear decrease in larval density. While the spleen and parasite rates in the untreated village remained the same or rose a little between 1937 and 1940, those in the treated village fell notably. Spleen rates in the malaria season dropped from 68 per cent. in 1937 to 6 in 1940, and parasite rates from 57 per cent. to 0. Spleen size was also reduced. A downward trend in spleen and parasite indices was apparent in the other treated villages.

Job (T. J.). **On the comparative Efficacy and relative Costs of biological and chemical Methods of Mosquito Control in clean-weeded Railway Borrow-pits at Fuleshwar, Bengal.**—*J. Malar. Inst. India* **4** no. 2 pp. 211–215, 8 refs. Calcutta, 1941.

A railway borrow-pit was divided into three sections, each 20 ft. by 12 ft., of which the first was dusted with 4 oz. 2 per cent. Paris green mixture every fifth day according to the routine procedure in the neighbouring area, the second was stocked with 96 adults and 48 young individuals of *Aplocheilus panchax*, and the third was left as an untreated control. The Paris green destroyed Anopheline larvae in the late instars only, other stages of Anophelines and all Culicines being unaffected. The fish destroyed first the older larvae and pupae of both Anophelines and Culicines and later the younger larvae ; the section was free of larvae and pupae four days after the introduction of the fish and remained so. All aquatic stages of mosquitos continued to thrive in the control section. Excluding expenditure on supervising staff, which is essential in chemical control, the cost of treatment with Paris green was more than 20 times that of introducing the fish.

THOMSON (R. C. M.). **Studies on the Behaviour of *Anopheles minimus*. Part V. The Behaviour of Adults in Relation to Feeding and Resting in Houses.**—*J. Malar. Inst. India* **4** no. 2 pp. 217–245, 1 fig., 13 refs. Calcutta, 1941. **Part VI. Observations on the Cold Weather Breeding Places.**—*T. c.* pp. 247–255, 3 pls., 7 refs.

The first paper, which is the fifth of a series on the biology of *Anopheles minimus*, Theo. [*cf. R.A.E.*, B **30** 103], deals with observations on its activity in houses, made over a period of three years, principally in the Assam Valley but also in the Dooars of North Bengal. The climate is discussed. The chief day-time resting place at any season was found to be the darker room in native houses and coolie huts, the preferred situations being dark horizontal under-surfaces, and to a smaller extent dark walls or hangings and floors. Individuals were found on clean thatched walls in the Dooars, but seldom on those covered with cobwebs, and they showed no tendency to burrow into the thatch or hide in deep cracks. The concentration of mosquitos was much greater in some houses than others, probably on account of their position or the fact that they contained specially suitable resting places. In a number of equally exposed houses, the largest number of adults was found resting by day in those that offered suitable resting places as well as opportunities for feeding. Unoccupied houses sometimes yielded a small number of adults if they contained suitable resting places. By day, the temperature of the day-time resting places was usually about 2°C. [3·6°F.] below the outside screen temperature or the temperature of cowsheds. This difference is considered too small to influence the mosquitos except possibly at times of unusually high temperature. The highest temperatures ever likely to be met with in a thatched house in Upper Assam and in the Dooars are 93·2°F. and 96·8°F., respectively. The light intensity of ideal resting places, even on a bright cloudless day, was usually less than 0·01 foot candle.

In cold weather, the period between feeding and oviposition was 4–6 days. Hibernation did not occur; the weather was never cold enough to prevent the maturation of the ovaries [*cf.* **25** 102]. During the 4–5 months of high temperature and humidity, females normally took two days to digest a blood-meal and oviposited on the second night after feeding. At this season, nearly all females caught by day could be divided into those in which blood occupied most of the abdomen and those that were gravid, the number of the former greatly exceeding that of the latter in nearly every catch. This disparity probably affords some indication of the daily mortality in nature. The mosquito population of a hut changed rapidly, and two or three weekly collections did not appreciably reduce the number present. The existence of this turnover of population in houses was confirmed by marking experiments. The fact that gravid females were taken in considerable numbers in the second of two searches in the same houses on consecutive days shows that fed females migrate from house to house, but adults disturbed in the day-time soon settled in another dark place. It is commonly believed that the mosquitos that leave houses in the early evening are driven out by the smoke of cooking fires, but this cannot be so, as many were found resting during the day in smoke-filled rooms. Caged mosquitos were attracted to light at sunset though this had not been the case during the day. The principal factor involved is probably the rapid change in light intensity, but behaviour may be influenced also by some diurnal rhythm. There was no similar attraction to light at dawn.

Observations under natural conditions in a hospital during the monsoon showed that 90 per cent. of the feeding takes place after midnight and very little in the first two or three hours after sunset. After ovipositing, the females returned for a blood-meal on the same night. Feeding continued until dawn. Gorged females caught in coolie houses laid averages of 137 eggs each during the monsoon (July–September) and 82 in the cold season (January). *A.*

minimus would not mate in captivity either in large or small cages outside or inside buildings, and unfertilised females soon digested a blood-meal, but there was no parallel development of the ovaries [*cf.* **28** 167]. An attempt to establish a colony of *A. vagus*, Dön., failed for the same reason. When females of either species caught in nature had oviposited in the laboratory, a single blood-meal was sufficient to bring about maturation of the ovaries and eventual oviposition. In experiments designed to establish whether the frequency with which *A. minimus* feeds on man is due to a host preference or to some physical difficulty in piercing the skin of animals, females fed quite readily on cow, goat, fowls and dog in the absence of man, cow and dog being the more acceptable. A slight decrease in feeding activity at the coldest time of the year was indicated by comparative experiments, but it was so small that no drastic change of behaviour or marked inhibitory effect of cold-weather temperatures on blood feeding was suggested. No marked reaction was shown when the mosquitos were exposed to a choice of atmospheric humidity, but when exposed to a choice of temperature, there was a strong avoidance of temperatures above 25°C. [77°F.] by hungry females and above 30°C. [86°F.] by fed ones. There was never any indication that hungry females were attracted to warmth, even below 15°C. [59°F.]. The fatal zone of temperature for adults of *A. minimus* at relative humidities of 25–90 per cent. was 37–38°C. [98·6–100·4°F.] and for *A. vagus*, 40–41°C. [104–105·8°F.]. A corresponding difference in susceptibility to high temperature was found in the larvae, which had thermal death points of 41°C. and 45°C. [113°F.], respectively. Laboratory experiments suggest that the expectation of life in *A. minimus* is greater at the end of the rainy season than in the hot dry spells before the rains.

The second paper deals with observations on cold-weather breeding places of *A. minimus* in Assam and the Dooars, as a result of which it is concluded that any programme of operations against this species should include, if possible, measures for its control in cold-weather breeding places from the beginning of the year, or the beginning of February at the latest, until they are flushed out by the heavy rains and control in the monsoon breeding places begins. Earlier laboratory experiments [**29** 71] had shown that development of eggs and pupae takes place at 16°C. [60·8°F.], the lowest mean temperature likely to be met with in a breeding place in the coldest part of the year, and pupae were found throughout the cold weather. Thus, on temperature considerations alone, the continual production of adults was indicated. The output of adults from a perennial river was estimated by collecting pupae from a given length of grassy river edge and keeping them in water with the same mean temperature as the river. In one such river in Upper Assam, one female per day was produced per 25 ft. of grassy edge from a collection made on 23rd January (the coldest month of the year) in 1940, per 19 ft. from one made on 23rd February 1939, and per 21, 10 and 19 ft. from collections made on 2nd March 1939. In another river, the mean output of females per day rose from one per 213 ft. of grassy edge in early February to one per 6½ ft. in early April, and the mean density of larvae in the same period rose from 63 to 585 per 100 ft. Breeding in many of these rivers can be simply controlled by removing the grass along the edges. In the dry zones of the Dooars, where the few perennial rivers have bare edges, the most important cold-weather breeding places were perennial seepages at the edge of the zone and small streams formed from them. The number of larvae and pupae found in these and the large numbers of engorged adults regularly found in adjacent coolie lines in March demonstrated their considerable importance. In the Dooars, the same breeding place may continue to produce *A. minimus* throughout the year without a break.

Sen (P.). **On the Microsporidia infesting some Anophelines of India.**—*J. Malar. Inst. India* **4** no. 2 pp. 257–261, 1 pl., 8 refs. Calcutta, 1941.

A study of the developmental stages of the Microsporidia found infecting Anopheline larvae collected from localities near Calcutta showed them to comprise at least three species of *Thelohania, viz., T. legeri* from *Anopheles hyrcanus* var. *nigerrimus*, Giles, *A. annularis*, Wulp, *A. ramsayi*, Covell, *A. varuna*, Iyen., *A. subpictus*, Grassi, and *A. vagus*, Dön., and *T. indica* and *T. anomala*, of which the latter is described as new, from *A. ramsayi*. The parasites occur almost throughout the year, but are particularly prevalent between April and September. The thorax of infected larvae becomes opaque and in advanced cases the abdomen also. Heavily infected larvae become very sluggish and usually die within 2–6 days in captivity.

In a paper already noticed [*R.A.E.*, B **18** 87], Kudo, working on material collected in Bengal by Iyengar [*cf.* **18** 134], described *T. legeri* from several of these Anophelines and also from *A. barbirostris*, Wulp, *T. indica* from *A. hyrcanus* var. *nigerrimus* and *T. obscura* from *A. varuna*.

Russell (P. F.) & Ramachandra Rao (T.). **On seasonal Prevalence of *Anopheles* Species in south-eastern Madras.**—*J. Malar. Inst. India* **4** no. 2 pp. 263–296, 2 pls., 6 graphs, 2 figs., 10 refs. Calcutta, 1941.

The following is substantially the authors' summary. The seasonal prevalences of *Anopheles aconitus*, Dön., *A. annularis*, Wulp, *A. barbirostris*, Wulp, *A. culicifacies*, Giles, *A. hyrcanus* var. *nigerrimus*, Giles, *A. jamesi*, Theo., *A. pallidus*, Theo., *A. subpictus*, Grassi, *A. stephensi*, List., *A. tessellatus*, Theo., *A. vagus*, Dön., and *A. varuna*, Iyen., in the newly irrigated area of the Pattukkottai taluk, Tanjore District, south-eastern Madras [*cf. R.A.E.*, B **27** 44] are discussed on the basis of data obtained through intensive collections of larvae and adults between March 1937 and February 1940. Meteorological and seasonal conditions are described and their relation to Anopheline prevalence discussed with special reference to *A. culicifacies*, which is the chief vector of malaria [*cf.* **30** 121].

Viswanathan (D. K.), Sribas Das & Oommen (A. V.). **Malaria-carrying Anophelines in Assam, with special Reference to the Results of twelve Months' Dissections.**—*J. Malar. Inst. India* **4** no. 2 pp. 297–306, 2 graphs, 6 refs. Calcutta, 1941.

In the period 1931–40 inclusive, 70,049 Anophelines were dissected by the Assam Medical Research Society. The species in which malaria parasites were found, with the number of each dissected and (in brackets) the number positive and the numbers having gut and gland infections were *Anopheles aconitus*, Dön., 1,145 (1, 1, 0) ; *A. annularis*, Wulp, 16,760 (9, 3, 6) ; *A. culicifacies*, Giles, 1,232 (6, 2, 5) ; *A. maculatus*, Theo., and var. *willmori*, James, 8,483 (29, 24, 5) ; *A. minimus*, Theo., 14,092 (725, 393, 391) ; and *A. philippinensis*, Ludl., 4,239 (4, 2, 2). This paper deals with the results of the 18,599 dissections made between July 1940 and June 1941. The specimens were received from 25 centres in the Province and belonged to 19 species. The species found infected, with data as above, were *A. aconitus*, 254 (1, 1, 0) ; *A. annularis*, 7,481 (11, 4, 7) ; *A. maculatus*, 1,573 (14, 13, 1) ; and *A. minimus*, 5,120 (154, 83, 72). The probable importance as a vector of malaria in Assam of each of the six species in which infection was found during the ten-year period is discussed. *A. minimus*, with sporozoite, oöcyst and total infection indices of 1·4, 1·6 and 3·0 in 1940–41, was the chief vector. *A. culicifacies* was found infected only in Lumding, a large railway colony, where *A. minimus* is more important. The authors' findings are in agreement with those of Afridi & Puri [*R.A.E.*, B **29** 4], who state that *A. culicifacies* occurs only in small numbers in Assam and does not play an important part in the transmission of malaria there ; but the

fact that it was found infected in Lumding shows that if the species comprises two races, only one of which is a vector [**29** 72], the vector race must be present though of slight consequence owing to its small numbers. Although no positive individuals of *A. annularis* were obtained until 1940, it is considered a vector of definite importance in the area where these were found (Gauripur and Lakhipur in Goalpara District), as it is the prevalent species there and no other was found infected. Sporozoites were found in it in February 1941, showing that transmission may occur during that month when the average daily temperature is below 60°F. *A. maculatus* was the only species found infected at Shillong in 1940–41, and *A. minimus*, the main vector there in 1932, was present only in extremely small numbers. As malaria was found in infants in November 1940 and February 1941, *A. maculatus* is considered a definite vector. The fact that it caused only low endemicity is attributed to its great preference for bovine blood. *A. aconitus*, in which only one gut infection was found in the area in which *A. annularis* is thought to be the chief vector, and *A. philippinensis*, which has not been found infected since 1933, are deemed to be of no importance.

Statistical analysis shows that the seasonal variations in infections of *A. minimus* are significant, but they may be due to possible differences in the seasonal infection in the different geographical areas from which specimens were received. Infection was found in this species in every month except February, the infection index curve showing peaks in March, June, August and October. The curve of adult prevalence had an almost flat peak from July to October, with a small decline in August.

Rao (G. R.). **Malaria in the Jharia Mining Settlement, Bihar.** (Abstract.)—*J. Malar. Inst. India* **4** no. 2 pp. 307–309. Calcutta, 1941.

A brief description is given of the Jharia mining settlement, which covers an area of 787 sq. miles in south-eastern Bihar. There is a well-marked malaria season, beginning in May, with the peak of incidence usually occurring in August or September. The numbers of the principal species of Anophelines dissected and (in brackets) the percentages showing gut and gland infection were: *Anopheles fluviatilis*, James, 813 (4·2, 2); *A. stephensi*, List., 423 (1·2, 1·7); *A. annularis*, Wulp, 798 (0·6, 0·25); *A. culicifacies*, Giles, 33 (0, 0); *A. subpictus*, Grassi, 1,625 (0, 0); and *A. vagus*, Dön., 1,843 (0, 0). No infection was found in six other species that were taken in very small numbers.

Agriculture and Animal Husbandry in India 1938–39.—422 pp., 10 pls. Delhi, 1941.

This report includes information on Arthropods infesting domestic animals (pp. 226–229). Negative results were obtained in experiments on the transmission of *Piroplasma* (*Babesia*) *gibsoni*, causing piroplasmosis of dogs, by *Haemaphysalis bispinosa*, Neum., and of *Theileria annulata* [in cattle] by a species of *Hyalomma* (here called *aegyptium* [but *cf. R.A.E.*, B **24** 196]). In the Central Provinces, heavy infestation by this species of *Hyalomma* caused the death of large numbers of goats, which showed symptoms of anaemia followed by progressive emaciation, but no evidence of protozoan or other infection. Examples of *Rhipicephalus haemaphysaloides*, Sup., that were received with a report that this species had caused the death of 15 goats in two months in a village in Bombay failed to transmit any infection to healthy goats. It is considered probable that in this case also, the deaths are attributable to anaemia caused by the presence of numerous ticks. During July, numerous individuals of *Hunterellus hookeri*, How., were bred from a consignment of *Haemaphysalis bispinosa* received from Sirsi, North Kanara. This parasite has only once previously, in 1921, been recorded from India.

It has been ascertained that in order to ensure the successful emergence of adults of *Hypoderma lineatum*, Vill., it is necessary to keep the pupae at a

temperature of 22°C. [71·6°F.] and a soil moisture of 5 per cent. Infestation of goats with *H. crossi*, Patt., was heavy in the Kashmir and Kulu Valleys and in hill districts of the North-West Frontier Province [**29** 54], and *H. lineatum* was widespread on cattle in this province, except in a damp and marshy district from which it was practically absent. It is suggested that excessive soil moisture is harmful to the pupae. *Rhinoestrus purpureus*, Brauer, which has not previously been recorded from India, was obtained from the head sinuses of a donkey in the Punjab. A skin disease reported to affect goats at Balakot in the North-West Frontier Province is believed to be due to *Sarcoptes caprae*, Fürst., but is characterised in its advanced stages by a stiffening and paralysis of the limbs, followed by death. Considerable loss was suffered in Mysore as a result of heavy infestation of poultry with *Eomenacanthus* (*Menopon*) *stramineus*, Nitzsch, *M. gallinae*, L., *Gallipeurus* (*Lipeurus*) *heterographus*, Nitzsch, *L. caponis*, L. (*variabilis*, Nitzsch), *Dermanyssus gallinae*, DeG., *Cnemidocoptes mutans*, Robin & Lanquetin, *C. laevis gallinae*, Raill., and *Cytoleichus nudus*, Vizioli.

GAPUZ (R. B.). **Derris Root Infusion for Sucking and Biting Lice of Mammals.**—*Philipp. J. Anim. Industr.* **8** no. 4 pp. 389–393, 6 refs. Manila, 1941.

An account is given of experiments carried out in the Philippines in which infusions of derris were tested for the control of sucking lice on cattle and water buffalo and biting lice on a horse by applying them liberally to the body with soaked rags at the rate of about 5 l. (1·1 gal.) per animal. The roots were pounded to pulp and steeped in water for two days; they were then withdrawn and rinsed repeatedly with water, which was added to the stock solution. Complete mortality of lice was obtained in every test. Infusions of dry root of an unidentified species of *Derris* were tested against the sucking lice at concentrations as low as 0·6 lb. root per 10 gals. water; an infusion of 1 lb. fresh root of *Derris philippinensis* in 4 gals. water was the only one tested against the biting lice. Sucking lice removed from the host and immersed in the infusion for 20 seconds were alive and apparently unaffected next day, and the author concludes that they are killed on the animal because they ingest some of the poison when they insert their proboscis into the skin.

HAYWARD (K. J.). **La cucaracha de la casa y su control.** [The domestic Cockroach and its Control.]—*Rev. industr. agríc. Tucumán* **31** no. 10–12 pp. 422–426, 5 figs.; also as *Circ. Estac. exp. agríc. Tucumán* no. 105, 7 pp., 5 figs. Tucumán, 1941.

The cockroaches that are household pests in Tucumán, Argentina, are *Periplaneta americana*, L., *Blattella germanica*, L., and *Blatta orientalis*, L. A brief account is given of the life-history and habits of cockroaches, and methods of control are described. These include the use of a trap consisting of a glass jar with a wide mouth into which a funnel of thick paper is inserted. The jar is laid on its side and the cockroaches are attracted into it through the funnel by slices of apple, etc., placed inside.

KRÜGER (F.). **Parthenogenetische *Stylotanytarsus*larven als Bewohner einer Trinkwasserleitung.** (*Tanytarsus*-**Studien III : Die Gattung** *Stylotanytarsus*.) [Parthenogenetic *Stylotanytarsus* Larvae in a Drinking-water System. (*Tanytarsus* Studies III. The Genus *Stylotanytarsus*.)]—*Arch. Hydrobiol.* **38** pt. 2 pp. 214–253, 3 figs., 4 pp. refs. Stuttgart, 1941.

An account is given of an infestation by Chironomids of the pipe-borne water in part of an unnamed German town. The larvae were first observed in the tap-water in 1937 and recurred at intervals until September 1939, though a suspension of pyrethrum was washed through the pipes and mains after

each of the eight outbreaks. Details are given of the successful rearing of the species concerned in the laboratory, and it is described from the adult female as *Stylotanytarsus inquilinus*, sp. n. It reproduces parthenogenetically and only females have been observed.

Symes (C. B.), McMahon (J.) & Haddow (A. J.). **Pyrethrum Powder : a preliminary Note on its Use in the Control of Insect Vectors of Diseases.**—*E. Afr. med. J.* **18** no. 12 pp. 360–376, 1 ref. Nairobi, 1942.

The results are given of preliminary experiments in Kenya Colony on the effectiveness of pyrethrum powder against various household insects. The first tests were carried out in normally occupied African quarters, and the results, details of which are given in tables, indicated that one light dusting of floors and walls is lethal to a variety of insects for three days, appreciable kills being obtained daily for this period even though the floors are swept. The powder was most effective against wingless insects and house-flies. More precise knowledge was sought in a large number of laboratory tests. Flies including *Musca cuthbertsoni*, Patt., *M. lasiophthalma*, Thoms., and *M. xanthomelas*, Wied., were immobilised in 1–5 minutes and died without recovery when dusted or allowed to come in contact with a surface that had been dusted at the rate of 0·25 gm. per sq. ft. or kept for one minute in an atmosphere charged with powder at the rate of 0·16 gm. per cu. ft. When flies were kept on trays of manure lightly dusted with second-grade powder, 75–90 per cent. died in two days, as compared with 6–30 per cent. in the controls. In two days, 84 per cent. of flies given cloths wetted with a suspension of fresh pyrethrum powder in sugar solution were dead or moribund. Treatment of small parts of individual flies immobilised them in periods that varied inversely with the extent of the area treated. All were affected to some degree after a minute, but some were not completely immobilised until 10 minutes had elapsed. In repetitions of these tests with powder that had been exposed to the atmosphere for over 48 and 72 hours, slightly longer was required for knock-down and immobilisation, but kill was as good as with fresh powder. Powder that had been exposed for 6 days gave a very low kill. Wetted powder appeared to be more rapid in action than dry. Powder wetted and dried in the air over a period of 11 days had only a temporary paralysing effect. Powder that had undergone steam distillation for about two hours for oil extraction and had been dried in an oven for two days, in the sun for three and in the laboratory for seven gave complete kill of flies that were dusted lightly with it and left in the dusted cage for 7 minutes, by which time all were knocked down. Out of 50 flies put into the cage next day, 46 were down in 48 hours ; and out of 50 put into the cage on the third day, 30 were down on the fourth. The powder was found to contain 0·54 per cent. total pyrethrins after distillation. Preliminary tests suggest that the volatile oil is extremely toxic to flies as a contact poison. Dusting pit latrines and their surroundings with pyrethrum every two or three days has reduced fly breeding considerably.

Fleas, including *Xenopsylla brasiliensis*, Baker, *C*[*tenophthalmus*] *cabirus*, J. & R., and *D*[*inopsyllus*] *lypusus*, J. & R., lightly dusted as in the first experiments on flies or placed in contact with a dusted surface for 5 minutes and then removed to powder-free surroundings, became immobilised in 3–10 minutes and died without recovering. Powder exposed to the atmosphere for 72 hours was toxic to the fleas after 30 minutes' contact, but after being exposed for 96 hours, it killed *X. brasiliensis* and *D. lypusus* but not *C. cabirus*. Powder exposed for 5 days had only a temporary paralysing effect. In an experiment to ascertain if fleas in various parts of a hut could be killed by a dusting not aimed directly at them, the results were not entirely conclusive, as some of the control fleas as well as many in the treated room died, but there was no doubt that fleas in the more exposed of the selected positions were killed by the powder in spite of being partly protected by being in a glass cylinder with fine

muslin ends. Powder blown through nozzles into thick thatch from the outside failed to penetrate it. The majority of a large number of fleas, mostly *D. lypusus*, and about half of the larvae found in burrows of *Arvicanthis abyssinicus* into which fresh powder had been blown were immobilised when found and died without recovering activity. Most of the fleas found in three other colonies of *A. abyssinicus* dusted in the same way died soon after the burrows were dug up. To test the effect of the powder on fleas that were still on rodents, rats were put into a closed box, powder was blown in at the rate of 0·5 gm. per cu. ft. and the rats and box were searched after 15 minutes. All the fleas found (*X. brasiliensis* and *X. cheopis*, Roths.) were moribund. Ten larvae of *D. lypusus* dusted lightly with fresh powder became completely immobilised in less than two minutes and did not recover. Powder from which the oil had been distilled was dusted on to ten fleas (six *X. brasiliensis*, one *C. cabirus* and three *D. lypusus*), all of which were immobilised in 10 minutes, and only two, both *D. lypusus*, were alive after 24 hours.

All lice (*Pediculus humanus*, L.) brought into contact for 5 minutes with fresh powder or with powder previously exposed to the air for 24, 48 and 72 hours were immobilised in less than 5 minutes, and died some hours later. When 10 lice were lightly dusted with powder from which the volatile oil had been distilled, they were immobilised in 5 minutes and died within 24 hours; of 10 lice left for 10 minutes on a surface dusted with a similar powder and then removed, two were still active after an hour and one was alive after 22 hours. Small tests with lice on a loose earth floor seemed to indicate that about twice the dosage used in the other experiments (*i.e.*, 0·5 gm. per sq. ft.) was required to immobilise them. The reason for this is not known. Fresh powder had about the same effect on bed-bugs [*Cimex*] of all instars as on the fleas, lice and flies. Very few survived contact with the powder for one minute. Fresh powder lightly dusted on to the eggs did not prevent hatching but quickly immobilised the newly hatched nymphs, which died without regaining activity. Powder from which the oil had been distilled gave a 50 per cent. kill in two days.

In experiments to ascertain the effect of the dust on mosquitos, huts of mud, poles and thatch with an interior wall, floor and ceiling area totalling about 423 sq. ft. were dusted at sunset with 1 or 2 oz. powder of various qualities. One hut was left as a control. A man slept in each hut to attract mosquitos. No living mosquitos were found in the treated huts in any of the tests during the first 12 hours after dusting. The reduction in mosquito populations in treated huts over the first three days after dusting varied between 42 and 68 per cent. The smallest reduction followed treatment with 1 oz. powder made from waste flowers and leaves. At the end of 30 days there was still an appreciable effect on the numbers of mosquitos found. Details are given of the results and of the species of mosquitos taken. No cases of dermatitis or respiratory troubles occurred among the thousands of Africans whose quarters were dusted as an anti-plague measure.

Papers noticed by Title only.

Svihla (R. D.). **A List of the Fleas of Washington** [with hosts].—*Univ. Wash. Publ. Biol.* **12** no. 2 pp. 9–19, 17 refs. Seattle, Wash., 1941.

Sacca (G.). **Introduzione allo studio biologico e sistematico del genere** *Phlebotomus* **(Diptera, Psychodidae).** [Introduction to the biological and systematic Study of the Genus *Phlebotomus* (including figures of anatomical details).]—*Riv. Parassit.* **5** pp. 53–66. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 143. Jena, 1942.)

Buxton (P. A.). **A Key to the adult** *Anopheles* **Mosquitos of the Mediterranean Region and the Lands adjoining the Red Sea and Persian Gulf : Supplementary Note** [corrections and additional data].—1 p. multigraph. London Sch. Hyg. trop Med., 1942. [*Cf. R.A.E.*, B **30** 48.]

Casini (G.). **Notizie e rilievi sull'epidemiologia della malaria in Albania fino al 1939-40.** [Notes on the Epidemiology of Malaria in Albania to 1939–40.]—*Riv. Malariol.* **20** (1) pp. 75–115. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 99. Jena, 1942.)

A survey is given of the geography and climate of Albania and the condition of the people in relation to disease, and work in the country in 1928–39 is described. Malaria is widespread, particularly along the coast and the rivers and mountain streams up to an altitude of about 3,600 ft. The most important vectors are *Anopheles maculipennis* var. *sacharovi*, Favr (*elutus*, Edw.) along the coast and *A. superpictus*, Grassi, inland, *A. maculipennis* var. *typicus* being less dangerous. *Plasmodium vivax* and *P. falciparum* predominate, while *P. malariae* is much rarer.

Coluzzi (A.). **L'endemia malarica a Valona.** [Endemic Malaria in Valona.]—*Riv. Malariol.* **20** (1) pp. 116–157. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 pp. 99–100. Jena, 1942.)

In the Valona district of Albania, the most important vector of malaria is *Anopheles maculipennis* var. *sacharovi*, Favr (*elutus*, Edw.). It becomes active in May and is commonest at the end of June and beginning of July. Malaria is endemic in all areas below an altitude of about 1,600 ft.

Pelazzi (A.). **L'endemia malarica a Durazzo.** [Endemic Malaria at Durazzo.]—*Riv. Malariol.* **20** (1) pp. 158–186. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 100. Jena, 1942.)

Observations in June–November 1940 showed that *Anopheles maculipennis* var. *sacharovi*, Favr (*elutus*, Edw.) is the most important vector of indigenous malaria in the district round Durazzo in Albania. The disease reached its peak in August–October, and in these months *Plasmodium falciparum* was more prevalent than *P. vivax* or *P. malariae*.

Floch (H.) & Abonnenc (E.). *Piroplasma bigeminum* **et** *Margaropus annulatus* **à la Guyane française.**—*Bull. Soc. Path. exot.* **33** pp. 407–410. 1940. *Piroplasma bigeminum* **et** *Boophilus annulatus microplus* **à la Guyane française.**—*Op. cit.* **34** pp. 121–124. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 111. Jena, 1942.)

In these two papers, the authors record the occurrence in French Guiana of *Piroplasma bigeminum* and its chief vector, *Boophilus annulatus microplus*, Can., and discuss its importance in connection with the possibility of introducing stock to improve the local breed of cattle.

Dubarry (—) & Giraud-Costa (—). **Fièvre de trois jours et éruption due aux piqûres réitérées de phlébotomes (Harara).**—*Bull. Soc. Path. exot.* **34** pp. 142–153. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 pp. 117–118. Jena, 1942.)

The authors describe the dermatitis known as Harara in Palestine, and conclude that it is a reaction produced by repeated bites of sandflies in persons who have recently come to the country and have not been long exposed to them [*cf. R.A.E.*, B **24** 37]. The frequent and simultaneous occurrence of Harara and sandfly (three-day) fever is due to the fact that *Phlebotomus* [*papatasii*, Scop.], the bites of which cause Harara, is also the vector of the fever, but Harara is not, as has been assumed, an exanthematic form of sandfly fever, nor is it an abnormal form of dengue.

(2311) Wt. P7/3717 1,400 12/42 S.E.R. Ltd. Gp. 432. [3]

MARCHIONINI (A.). **Zur Klimatophysiologie und -pathologie der Haut. III. Mitt. Die Phlebotomenepizoonose (sog. Harara) in Anatolien.** [On the climatological and pathological Physiology of the Skin. Contribution 3. The Affection due to *Phlebotomus* (known as Harara) in Anatolia.]—*Arch. Derm. Syph.* **182** pp. 127–173. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 pp. 118–119. Jena, 1942.)

Numerous cases of Harara [*cf.* preceding abstract] occur in Anatolia, Syria and Palestine during the summer, starting at the beginning of the flight period of *Phlebotomus* in the second half of May. Clinical data are given. The species of *Phlebotomus* in Anatolia are *P. papatasii*, Scop., *P. perniciosus*, Newst., *P. minutus*, Rond., and *P. sergenti*, Parrot ; the dermatitis is mainly due to *P. papatasii* and was observed to be most prevalent in months in which the temperature favours the development of this sandfly.

WENDT (A.). **Beitrag zur Kenntnis der Verbreitung und Lebensweise der Schwalbenwanze (*Oeciacus hirundinis* Jen.) in Mecklenburg.** [Contribution to the Knowledge of the Distribution and Biology of *O. hirundinis* in Mecklenburg.]—*Arch. Ver. Naturg. Mecklenb.* (N.F.) **14** pp. 71–94. 1939. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 138. Jena, 1942.)

An account is given of observations on the bionomics of *Oeciacus hirundinis*, Jenyns, which was found to be widely distributed in the nests of house-martins in Mecklenburg. Only two cases of its invading houses were observed, but it was successfully reared on human blood, and so can evidently live on man.

NICOLLE (P.). **Appareil pour l'alimentation artificielle des réduvidés hémophages.**—*Bull. Soc. Path. exot.* **34** pp. 179–185. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 138. Jena, 1942.)

The author describes the construction and successful use of an apparatus in which blood-sucking Reduviids can be fed through a membrane on fluids warmed by water the temperature of which can be regulated.

WEYER (F.). **Neuere Beobachtungen über die Winterruhe bei *Anopheles maculipennis*.** [Fresh Observations on Hibernation in *A. maculipennis*.]—*Z. Parasitenk.* **12** pp. 157–164. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 139. Jena, 1942.)

A comparison is made between the hibernation habits in Germany of *Anopheles maculipennis* var. *atroparvus*, van Thiel, which feeds on cattle during the winter, and var. *messeae*, Flni., which does not [*cf. R.A.E.*, B **27** 77]. In experiments, however, females of var. *atroparvus* survived the winter without feeding and fed and oviposited normally in spring.

LUPASCU (G.). **Contributo allo studio della biologia larvale dell' *A. claviger* (*bifurcatus*).** [Contribution to the Study of the larval Habits of *A. claviger*.]—*R. C. Ist. Sanità pubb.* **3** no. 4 pp. 894–925. 1940. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 141. Jena, 1942.)

Experiments in Italy showed that a constant temperature is more favourable to the larval development of *Anopheles claviger*, Mg., than a variable one. Its variety *petragnani*, Del Vecchio, appeared to be more resistant to the temperature variations within the 24 hours, and also to the greater variations that occur during the period required for development, than var. *missiroli*, Del Vecchio. The optimum temperature of the water for larval development is 21-22°C. [69·8–71·6°F.] for var. *petragnani* and probably a little lower for var. *missiroli*.

Lupascu (G.). **Sull' esistenza di due diverse varietà di** *Anopheles claviger*. [On the Existence of two different Varieties of *A. claviger*.]—*R. C. Ist. Sanità pubb.* **3** no. 4 pp. 926–942. 1940. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 141. Jena, 1942.)

Studies by the author have shown that the two varieties *petragnani* and *missiroli* of *Anopheles claviger*, Mg., recently described by Del Vecchio [*R.A.E.* B **27** 175] can be distinguished not only by characters of the eggs and pupae, but also by differences in the chaetotaxy of the larvae. The latter also react differently to temperature [*cf.* preceding abstract].

Schwetz (J.). **Une invasion de moustiques provoquée par une éruption volcanique.**—*Bull. Soc. Path. exot.* **33** pp. 331–332. 1940. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 142. Jena, 1942.)

This is a preliminary note on the breeding of *Anopheles pharoensis*, Theo., in Lake Kivu after a volcanic eruption [*cf. R.A.E.*, B **30** 152]. Favourable breeding places were provided by aquatic plants that were uprooted from the depths of the lake by the lava from the volcano, floated to the surface and were blown into a bay. As the algae slowly disappeared, the numbers of the mosquito correspondingly diminished.

Nicolay (—). **Note sur l'***Anopheles pharoensis* **Theo. à Boma (Congo belge).**—*Bull. Soc. Path. exot.* **33** pp. 324–328. 1940. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 142. Jena, 1942.)

Anopheles pharoensis, Theo., is a seasonal mosquito at Boma. It breeds when the Congo is in flood and almost disappears in the dry season, though the temperature throughout the year is favourable for oviposition and for adult emergence.

Schwetz (J.). **Contribution à l'étude des anophélinés du Congo oriental (Lac Kivu-Lac Albert).**—*Ann. Soc. belge Méd. trop.* **21** pp. 17–35. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 p. 142. Jena, 1942.)

Anopheles christyi, Newst. & Cart., predominates in the uplands above Lake Kivu, in the Belgian Congo, while *A. pharoensis*, Theo., is found along the shores of both Lake Kivu and Lake Albert together with *A. squamosus*, Theo. Below about 5,300 ft. there are several more widely distributed species, of which the most dangerous are *A. gambiae*, Giles, and *A. funestus*, Giles. A list of the 13 species found is given.

Eichler (W.). **Morphologische und biologische Merkmale mitteleuropäischer Dasselfliegen und ihrer Larven.** [Morphological and biological Characters of Central European Warble Flies and their Larvae.]—*Z. Parasitenk.* **12** pp. 95–106. 1941. (Abstr. in *Zbl. Bakt.* (I. Ref.) **141** no. 5–6 pp. 143–144. Jena, 1942.)

The author discusses the classification, nomenclature and host specificity of species of *Hypoderma* that occur in Central Europe. In addition to the ox warble flies, *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., they comprise *H. diana*, Brauer, which attacks roe, red and fallow deer, elk and chamois, and *H. actaeon*, Brauer, which attacks red deer.

O'Loghlen (J. E.). **Treatment of Scabies.**—*Brit. med. J.* no. 4265 p. 416. London, 1942.

The author reports the successful treatment of scabies in man [caused by *Sarcoptes scabiei*, DeG.] during the past 20 years, by applying a solution of 1 part sodium hyposulphite [thiosulphate] in 5 parts water to the whole body with

a piece of cotton-wool, allowing it to dry for a few minutes and then applying a 5 per cent. solution of hydrochloric acid in the same way [*cf. R.A.E.*, B **29** 182–183]. The patient retires to bed without drying the body. The treatment is repeated on the next day, but it is rarely necessary to make applications on the third day. This treatment does not damage clothing or irritate the skin, and stops itching at once. The solution has no odour.

MEGAW (Sir J. W. D.). **Louse-borne Typhus Fever.**—*Brit. med. J.* nos. 4265–4266 pp. 401–403, 433–435, 7 graphs. London, 1942.

An account is given of the history, distribution in general and in 1942, causal organism, clinical features, diagnosis, treatment and fatality rate of the classical form of typhus transmitted by lice [*Pediculus humanus*, L.], with special reference to its increased incidence and severity in time of war. The preventive measures discussed are inoculation and the elimination of infestation by lice, of which the latter is considered the better. The difficulty of effecting it in time of war is pointed out. To obviate the risk of infection through louse excreta [*cf. R.A.E.*, B **25** 156] of personnel engaged in typhus work, it is recommended that the skin of infected persons should be treated with chemical antiseptics, such as a mixture of 1½ oz. Jeyes' fluid, 1½ lb. soft soap and 10 gals. water applied before a bath, and that clothing and bedding should be disinfected with heat rather than freed from lice with hydrocyanic acid gas. Special louse-proof clothing should be worn by persons exposed to risk, or failing this, rubber gloves and gum-boots into which sleeves and trousers are tucked; and arms and legs should be smeared with camphorated oil made of camphor and olive oil or liquid paraffin (1 : 9).

In conclusion, comparative data on the flea-borne, tick-borne and mite-borne forms of typhus are given and tabulated.

PERCIVAL (G. H.). **The Cure of Scabies, and a new Remedy.**—*Brit. med. J.* no. 4267 pp. 451–452, 5 refs. London, 1942.

As sulphur, when used for the control of scabies [*Sarcoptes scabiei*, DeG.], requires the addition of fats and oils, which are in short supply, tests were made with tetraethylthiuram monosulphide [*cf. R.A.E.*, B **30** 118] in an attempt to find satisfactory methods of treatment that do not require fats and oils or only small amounts of them. This substance, which is cheap, clean and easily available, did not irritate the skin when applied as an undiluted powder. It effected cures in four out of 25 cases when applied as a 0·25 per cent. solution, in one case in which it was applied at 5 per cent. in a vanishing cream, in one case out of three in which it was applied as a paste and in 50 consecutive cases when applied in the form of a preparation composed of 25 per cent. tetraethylthiuram monosulphide, 10 per cent. polyglycerol ricinoleate and 65 per cent. industrial methylated spirit, emulsified with 4 parts water immediately before use. The diluted emulsion was not stable if allowed to stand. The liquid was rubbed twice daily for three days over the whole body with the exception of the head and neck.

MALLEN (K. C.). **Benzyl Benzoate in Treatment of Scabies. A Comparison of the Effects of aqueous and spirit Emulsions.**—*Brit. med. J.* no. 4267 pp. 452–453. London, 1942.

Out of 527 men treated for scabies [*Sarcoptes scabiei*, DeG.] with a spirit emulsion and 448 treated with an aqueous emulsion of benzyl benzoate [*cf. R.A.E.*, B **30** 145], 519 and 447, respectively, were cured. The strength of the two emulsions was the same. On two successive days, each man was given a bath, scrubbed, and treated with one or other of the emulsions. Treatment on

the third day was required in 28 cases and on the fourth day in 3 cases. Dermatitis occurred in 6 of the cases treated with the spirit emulsion, and 14 of those treated with the aqueous emulsion, but it is thought that 11 of the 14 may be attributable to the type of soft soap used in preparing the emulsion. The situation of the lesions in a large proportion of the cases supported the theory that scabies is contracted by close bodily contact [**29** 182 ; **30** 145].

MURPHEY jr. (M.). **Household Insects.**—*Bull. Ga Dep. Ent.* no. 81, 39 pp., 11 figs., 9 refs. Atlanta, Ga., 1940. [Recd. 1942.]

A brief account is given of the life-history and control of various Arthropods that infest houses in Georgia, where the mild climate makes it possible for many of them to breed in the open, and they are consequently plentiful. Those dealt with include mites that attack man, cockroaches, bed-bugs [*Cimex*], fleas, mosquitos and the house-fly [*Musca domestica*, L.].

BUNYEA (H.) & WEHR (E. E.). **Diseases and Parasites of Poultry.**—*Fmrs' Bull. U. S. Dep. Agric.* no. 1652 (revd.), 82 pp., 34 figs., 13 refs. Washington, D.C., 1941.

This bulletin contains sections on malaria of pigeons, caused by *Haemoproteus columbae* and transmitted by *Pseudolynchia canariensis*, Macq. (*maura*, Big.), on the parasitic worms that infest poultry in the United States, some of which have insects as intermediate hosts, and on Arthropod parasites, which, in addition to *Echidnophaga gallinacea*, Westw., *Argas persicus*, Oken (*miniatus*, Koch) and the usual lice and mites, include bugs, beetles and flies. *Cimex lectularius*, L., *Haematosiphon inodorus*, Dugès (Mexican chicken bug), *C. columbarius*, Jenyns (European pigeon bug) and *Oeciacus vicarius*, Horv. (swallow bug) may be serious pests of domestic birds. The bugs live in the nests and attack the birds at night, sometimes causing sitting hens to desert their eggs. Larvae of *Dermestes lardarius*, L., and *Tenebrio molitor*, L., occasionally kill nestling pigeons by eating away the skin at the vent and neck, thus producing serious sores, and larvae of burying beetles, *Necrophorus* sp., may also attack these birds. Adults of *T. molitor* attack the feet of sitting hens. Larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), *Lucilia* spp., and *C. macellaria*, F., sometimes occur on domestic birds, the eggs having been deposited in sores or the natural openings of the body. Rose chafers [*Macrodactylus subspinosus*, F.], which occur in the Atlantic Coast, Middle West and Central States, are extremely poisonous to chicks less than 10 weeks old, which devour them readily. Only a few are necessary to cause death.

NEITZ (W. O.), ALEXANDER (R. A.) & MASON (J. H.). **The Transmission of Tick-bite Fever by the Dog Tick** *Rhipicephalus sanguineus*, **Latr.**—*Onderstepoort J. vet. Sci.* **16** no. 1–2 pp. 9–17, 13 refs. Pretoria, 1941.

An account is given of experiments in which rickettsiae of the Robertson strain of South African tick-bite fever, for which the name *Dermacentroxenus rickettsi* var. *pijperi* has been suggested [*R.A.E.*, B **28** 252], were transmitted by *Rhipicephalus sanguineus*, Latr., to healthy guineapigs from reacting ones infected by injection of egg-membrane cultures. Ticks infected as larvae and nymphs transmitted the infection as nymphs and adults, respectively, and the progeny of ticks that had fed in both the nymphal and adult stages on guineapigs showing febrile reaction transmitted it when in the larval stage.

DU TOIT (R.). **Description of a Tick** *Rhipicephalus glabroscutatum*, **sp. nov., (Ixodidae) from the Karroo Areas of the Union of South Africa.**—*Onderstepoort J. vet. Sci.* **16** no. 1–2 pp. 115–118, 2 figs. Pretoria, 1941.

Descriptions are given of the larva, nymph and adults of both sexes of *Rhipicephalus glabroscutatum*, sp. n., from goats and sheep in the south-east central

areas of Cape Province. Rearing on guineapigs and rabbits showed that it is typically a two-host tick, most of the larvae moulting on the host, though a few detached and dropped after engorgement. Records are given of the feeding periods of the larvae and nymphs and of the moulting period of the nymphs.

HADDOW (A. J.). **The Mosquito Fauna and Climate of Native Huts at Kisumu, Kenya.**—*Bull. ent. Res.* **33** pt. 2 pp. 91–142, 24 graphs, 20 refs. London, 1942.

The following is almost entirely taken from the author's summary. An investigation on the mosquitos frequenting native huts at Kisumu, Nyanza Province, Kenya, was carried out between April 1940 and October 1941. Brief descriptions are given of the locality, which is highly malarious, and of its climate. The local vectors of malaria are *Anopheles gambiae*, Giles, and *A. funestus*, Giles. The catching methods were standardised during preliminary collections, and subsequently four identical huts, the specification of which is given, were built side by side for comparative work. Every week for a year, one night catch and six day catches were made in one hut, which was regarded as a control. Records of climate in this hut showed that the temperature range was only about half that in the screen ; the temperature very rarely fell below the level at which development of the malaria parasite in the mosquito is arrested. The range of relative humidity was also much smaller than in the screen. A hut containing ten natives at night was slightly warmer than one containing one native, and its relative humidity was somewhat lower. High wind at night, which was unusual, stopped the entry of mosquitos into huts.

A list is given of all the mosquitos taken, with locality records and sites of capture (huts, tents, cowsheds, river banks or in the open). They comprised 13 species of *Anopheles*, 5 species and one variety of *Mansonia* (*Taeniorhynchus*), 8 species of *Aëdes* and 12 of *Culex*. Night catches in huts showed that there was a high population of resting females of *A. gambiae* at 7 p.m., a period of low entry from 8 to 10 p.m., one of high entry from 11 p.m. to 5 a.m. and a sharp entry peak at 6 a.m. The situation with regard to *A. funestus* was similar except that the period of low entry lasted until 2 a.m. Most of the females of both species taken were fed. There was close correlation between the curves for fed and total females. It is thought that females remain in the hut after feeding. Mature individuals with group V ovaries [*R.A.E.*, B **29** 93] entered mainly at dawn. Males of both species were scarce during the night, but entered in large numbers at 6 a.m. to rest during the day. *A. coustani*, Lav. (represented by var. *ziemanni*, Grünb.) and *A. pharoensis*, Theo., were scarce in the evening and at dawn. *A. coustani* showed a well-defined entry peak from 11 p.m. until midnight, and *A. pharoensis* from midnight until 2 a.m. *Mansonia uniformis*, Theo., showed a distinct entry peak at 9 p.m. and *M. africana*, Theo., from 9 to 11 p.m. There was a close correlation in this case between unfed and total females. It is thought that these species leave the hut soon after biting and that they bite most between 9 and 11 p.m. The other species were not sufficiently numerous to warrant individual discussion. Comparison of night catches in dark and dimly lighted tents showed that *A. coustani*, *M. africana* and *M. uniformis*, which entered the tents in large numbers, preferred the lighted one. *C. nebulosus*, Theo., preferred the dark tent. *A. funestus*, the only other species taken in considerable numbers, showed no marked preference. *A. gambiae* and *A. funestus* preferred to bite in huts rather than in the open, while the reverse was the case with *M. africana* and *M. uniformis*.

Comparison of night and day catches showed that the mosquitos taken may be divided into true house-haunting species (*A. gambiae* and *A. funestus*), which enter for both food and shelter and of which the females are abundant both by night and by day and the males by day only ; species that enter mainly to feed

(*M. africana* and *M. uniformis*, perhaps *A. coustani* and *A. pharoensis*), the females being common by night but never numerous by day, and the males always scarce; species that enter human habitations mainly for shelter (*C. antennatus*, Beck.), the females of which are prevalent by day only; and species that enter casually and are scarce both by night and day. Analysis of day catches showed that a vast majority of females of *A. gambiae* and *A. funestus* had grade I wings [*loc. cit.*] but they had ovaries in all stages of development. Sometimes the wings were still undamaged when the ovaries were maturing for the second time. Ovary dissections of these species showed that the largest numbers belonged to Group I and that the percentage in this group became higher at times of increase. Most females of these species and of *M. africana* and *M. uniformis* contained blood. Of the unfed *A. gambiae* and *A. funestus*, the great majority had Group I ovaries, and so were probably not more than 36–48 hours old. The numbers of males and females taken were closely correlated throughout. In day catches, the great majority of Anophelines were taken on the ceiling. *Mansonia* spp. were commonest on the walls. Very few mosquitos were found on the floor. With regard to mosquitos taken on the walls, it was found that all species preferred the lower and darker half. Catches made on the outside of the walls consisted mainly of male Anophelines. There was no significant difference between catches made at all hours from 6 to 11 a.m.

An indication in preliminary tests of a relation between the numbers of human inhabitants of a hut and the numbers of mosquitos taken was confirmed by night and day catches made simultaneously in huts with 1, 5, 10 and 15 inhabitants. There was a very close direct relation between the size of the human population and the number of females of biting species. Non-biting forms did not discriminate to a great extent. In a comparison between huts containing 5 washed and 5 unwashed natives, all the important biting species preferred the hut with unwashed natives. *C. antennatus* showed no discrimination. In night catches, females of *A. gambiae* and *A. funestus* preferred a hut containing dirty clothing only to a completely empty hut. Females of *M. africana* and *M. uniformis* showed no such preference. Catches in empty huts showed a higher proportion, but not a higher number, of males than catches in inhabited huts. It was found that a hut subdivided with a hessian curtain could be used for preference experiments with varying human populations. *A. gambiae* and *A. funestus* were more numerous both by day and by night in a hut containing a native than in one containing a calf. The preference was more marked in *A. funestus*. *A. coustani*, *A. pharoensis* and *C. antennatus* showed a distinct preference for the calf. Anophelines formed 94 per cent. of the total catch in the hut with the native, and only 5 per cent. in the hut with the calf. It is shown that the seasonal incidence of *A. gambiae* at Kisumu is dependent on local rainfall. A threshold figure of 5 ins. of rain per month is necessary before an increase can take place. The seasonal incidence of *A. funestus* is not connected with local rainfall but with the level of Victoria Nyanza. The seasonal incidence of other species is briefly discussed.

Parasitic mites were commonest on *A. coustani*, practically all individuals of which bore at least one. In December 1940, they became prevalent on females of *A. gambiae*. Infestations of 20–30 mites per mosquito were noted, and it seems likely that heavy infestations of this type may cause the death of the mosquito in nature. The fungus, *Coelomomyces africanus*, which causes destruction of the ovaries, was found in females of *A. funestus* and *A. gambiae*, being commoner in the former. This is the first record of its occurrence in Kenya. Naturally infected larvae were found, but attempts to infect others by feeding them on infected ovary were unsuccessful. Attempts to render adult mosquitos individually recognisable by staining the larvae with various dyes [*cf.* **27** 79] and to make the blood-meal recognisable by injecting identifiable substances into the blood-stream of the human bait were also unsuccessful.

De Meillon (B.). **Estudos entomológicos da Colónia de Moçambique.**—315 pp., 2 fldg. maps, ill. Lorenzo Marques, Estac. anti-malár., 1941.

This publication on Anophelines in Portuguese East Africa comprises a series of five papers recording the results of investigations by the author in 1938 and 1940.

In the first, Relatório acêrca dos vectores do paludismo em alugumas partes da Africa Oriental Portuguesa, com sugestões para o seu combate (pp. 7–44), he gives an account of a survey in 1938 of the breeding places of *Anopheles gambiae*, Giles, in the Island of Mozambique [*cf. R.A.E.*, B **27** 212], records the breeding places of *A. gambiae* and *A. funestus*, Giles, in Lorenzo Marques and reviews the habits of these species, which are important vectors of malaria, and of *A. coustani* var. *tenebrosus*, Dön., which is zoophilous.

The second, Breves considerações sôbre o *Anofeles gambiae* Giles e *Anofeles coustani* var. *tenebrosus* Dönitz, na Africa Austral (pp. 45–53), is a translation of a paper already noticed [*loc. cit.*].

In the third, Relatório sôbre os vectores da malária em Lourenço Marques durante a estação fria (pp. 55–60), he describes two winter breeding places of *A. gambiae* and *A. funestus* found in Lorenzo Marques between 28th July and 3rd August 1938. Adults of both species were comparatively numerous in dwellings nearby. None was found infected with malaria parasites, but it is considered that some transmission may occur in winter and that control measures should not be relaxed during this season.

In the fourth, Relatório da Missão Entomológica da Colónia de Moçambique (Africa Oriental Portuguesa) (pp. 61–136), he records the localities surveyed in 1940 and the Anophelines and breeding places found in each, with some suggestions as to control. In addition to those already noticed [**29** 200], the species taken comprised *A. marshalli*, Theo., *A. gambiae*, *A. coustani*, Lav., *A. coustani* var. *ziemanni*, Grünb., *A. squamosus*, Theo., *A. rufipes*, Gough, *A. demeilloni*, Evans, *A. pharoensis*, Theo., *A. nili*, Theo., *A. theileri*, Edw., *A. pretoriensis*, Theo., *A. longipalpis*, Theo., *A. rhodesiensis*, Theo., *A. natalensis*, Hill & Haydon, and *A. maculipalpis*, Giles.

In the fifth, Guia para a identifição dos anofelinos da Colónia de Moçambique, com notas acêrca dos seus hábitos e lugares de criação (pp. 137–313), he describes the technique of collecting, breeding and preparing Anophelines and the characters distinguishing a larva and an adult, and gives keys to the last-instar larvae and the adults of the Anophelines taken or likely to occur in the colony, brief descriptions of them and notes on their habits and breeding places.

A Review of the Control of Malaria in Palestine (1918–1941).—[1+] 40 pp., 5 maps (1 fldg.). Jerusalem, Dep. Hlth Palestine [1941]. Price 150 *mils*. [*3s.* 1½*d.*]

This review of the effect of the anti-malaria measures that have been carried out in Palestine since the British Occupation in 1918, when malaria was endemic throughout the country, includes introductory information on the population, social and economic conditions, physiography and climate, and surveys of the position before 1918, from 1918 to 1925 [*cf. R.A.E.*, B **14** 127; **16** 181], and from 1925 to 1941. In 1941, certain thinly populated areas such as the Huleh Marshes [**19** 123] still had spleen rates of up to 100 per cent., as money was not available for control in such places. Others in which control was in progress had a high, though decreasing, degree of infection, while in any area in which control measures were relaxed, a violent epidemic resulted during the malaria season. Malaria in the towns had become very slight. In Jerusalem, Safad, Haifa and Jaffa, the spleen rates were 44·3, 68·7, 39 and 16·6 per cent. in 1919 and 1·6, 1·0, 0·9 and 0 per cent. in 1940. The general rural spleen rate, based on examinations of the children from over 500 villages throughout the country, was 12 per cent. in 1925 and 5·4 per cent. in 1940. Malaria is still endemic in

every region of Palestine. In the hill zone, an epidemic manifestation of benign tertian [*Plasmodium vivax*] frequently occurs from June to September, and less frequently one of malignant tertian [*P. falciparum*] from August to December. In the coastal zone, epidemics usually occur only in June–August and are of the benign tertian type. Quartan malaria [*P. malariae*] is negligible.

Nine species of *Anopheles* are known to be present in Palestine [**18** 188; **20** 3; **21** 247]. *A. claviger*, Mg. (*bifurcatus*, auct.) is the outstanding urban species, breeding in wells and cisterns. It was common in all towns and villages throughout the year before steps were taken to close, mosquito-proof or oil all wells and cisterns [**18** 188]. *A. maculipennis* var. *sacharovi*, Favr (*elutus*, Edw.), the major rural vector, is generally abundant in houses throughout the late spring and early summer. Its common breeding places are stagnant pools in stream beds, wells and reservoirs overgrown with algae, and swamps in which the water is stagnant or has a sluggish motion. Larvae of *A. sergenti*, Theo., are also sometimes found in semi-stagnant swamps, but usually in very slowly moving streams and seepage under rocks and pebbles. The adults are most common from September to November, when malignant tertian is prevalent. Like *A. m. sacharovi*, *A. superpictus*, Grassi, begins to breed towards the end of March and continues until the beginning of the heavy November rains. The larvae are found in the eddies and backwaters of steadily flowing, fairly rapid streams that emanate from springs, and are free from grass or weeds, but may occur in stagnant pools or channels amid green algae, or clinging to stones, near running water. *A. hyrcanus* var. *sinensis*, Wied., is characterististic of large areas of stagnant marsh, but occasionally breeds in small streams where the current is sluggish and the bed overgrown. *A. algeriensis*, Theo., is similar to *A. h. sinensis* in its breeding habits, but possibly prefers those parts of a marsh in which some slight current is discernible. *A. multicolor*, Camb., breeds in brackish water and thus occurs only near the coast and in the Jordan Valley. *A. pharoensis*, Theo., and *A. coustani*, Lav. (*mauritianus*, Grp.) are marsh breeders and appear to be unimportant. *A. claviger*, *A. m. sacharovi*, *A. sergenti* and *A. superpictus* all breed freely, are known to enter houses and have been found to be associated with outbreaks of malaria. *A. hyrcanus* and *A. algeriensis* are of less importance, because they are usually confined to the marsh areas in which they breed.

A summary is given of the methods of control in use, which fall into two groups, urban methods directed against *A. claviger* and rural methods against the remaining Anophelines. The cost of anti-malarial operations to the community is discussed.

Baumann (F.). **Autochthone Malaria in Württemberg.**—*Dtsch. tropenmed. Z.* **45** pts. 16–18 pp. 481–495, 513–530, 545–560, 2 graphs, 4½ pp. refs. Hamburg, 1941.

This is a detailed discussion of the literature on the occurrence of malaria in Württemberg. It was almost unknown there at the beginning of the nineteenth century, but epidemics occurred about 50 years later. Only four cases of indigenous malaria were reported between 1917 and 1935. The commonest species of *Anopheles* and the only one of any importance as a vector is *A. maculipennis*, Mg., which is found in dwellings and animal quarters. Drainage and cultivation of the land, and the deflection of Anophelines from dwellings to animal quarters owing to increased warmth in the latter are among the factors considered responsible for the regression of malaria.

Mumford (E. P.). **Mosquitoes, Malaria and the War in the Pacific.**—*Science* **96** no. 2487 pp. 191–194, 1 map, 4 refs. Lancaster, Pa., 1942.

Attention is drawn to the importance of the problem of the distribution of malaria and its vectors in the Pacific theatre of war. Available data indicate

that malaria occurs on practically all the islands between New Guinea and 170°E. and the equator and 20°S. (including Rennell on the basis of recently obtained information), but authorities do not agree as to the situation in New Caledonia. The occurrence of *Anopheles punctulatus*, Dön., there has been recorded by some workers, while others consider that the island is free from Anophelines and malaria. The question is of particular importance in view of the situation of the island on the supply route between the United States and Australia and the presence of United States troops there.

So far as can be ascertained, there are two species of *Anopheles* in the Pacific Islands east of New Guinea. *A. punctulatus* and its variety *moluccensis*, Sw. & Sw., range as far east as the New Hebrides, and both are proved carriers of malaria. The other species, apparently undescribed, is known only from larvae taken in New Britain. *A. punctulatus* and var. *moluccensis* can breed in any kind of water, and the danger of their spread through the Pacific Islands is now great as a result of constantly increasing air traffic and disturbed conditions. It is considered not unlikely that New Caledonia and even Hawaii and the islands of the Central Pacific will cease to be free from malaria before the end of the present war.

Gabaldon (A.), Cova-García (P.) & López (J. A.). **Estudios sobre anofelinos. Serie II. 1.** *Anopheles* (*Nyssorhynchus*) *benarrochi*, **una especie de la subserie** *triannulatus*. [Studies on Anophelines. Series II. 1. *A. benarrochi*, a Species of the *triannulatus* Subseries.]—*Publ. Div. Malariol.* no. 7 pp. 3–23, 2 pls., 4 figs., 1 ref. Caracas, 1941. (With a Summary in English.)

Descriptions are given of the egg, larva, pupa and male hypopygium of *Anopheles benarrochi*, a new species of the *triannulatus* subseries of the *albimanus* series of the *Nyssorhynchus* group [*R.A.E.*, B **29** 177] from Venezuela. The coloration of the females is similar to that of others of the *albimanus* series, but the male terminalia and certain larval characters are distinct from those of *A. triannulatus*, Neiva & Pinto, and *A. strodei*, Root, the other members of the subseries. The egg differs from that of all other species of the *Nyssorhynchus* group.

Gabaldon (A.), Cova-García (P.) & López (J. A.). **Estudios sobre anofelinos. Serie II. 2.** *Anopheles* (*Arthuromyia*) *vargasi*, **n. sp. y redescripción del subgénero** *Arthuromyia* **Galvao, 1941.** [Studies on Anophelines. Series II. 2. *A. vargasi*, sp. n., and Redescription of the Subgenus *Arthuromyia*.]—*Publ. Div. Malariol.* no. 7 pp. 25–55, 3 pls., 4 figs., 4 refs. Caracas, 1941. (With a Summary in English.)

Descriptions are given of all stages of *Anopheles* (*Arthuromyia*) *vargasi*, sp. n., which was found in 1941 at an altitude of about 3,000–4,000 ft. in Monagas, Venezuela. The larvae were taken in a stream inside a cave, up to a distance of over 150 yards from the entrance, and also in the neighbouring ravine, where they were attached to floating leaves in dark stagnant flood pools with a temperature of 12–17°C. [53·6–62·6°F]. Adults that proved to belong to the same species were found inside the cave and in sheltered places outside, but not in houses in the immediate neighbourhood. Only four of the females taken contained blood; these were feeding on man in full daylight. Pupae and adults were reared from the larvae in a small laboratory established near the entrance of the cave at an altitude of about 3,100 ft., and eggs were obtained from the females that had had a blood-meal, but attempts to rear the larvae at altitudes of 1,300 and 660 ft. failed. The average temperature, relative humidity and barometric pressure at the type locality were 19·8°C. [67·64°F.], 90·0 per cent., and 680·3 mm.

A. vargasi belongs to the subgenus of which *A. gilesi*, Neiva, was previously the only known species [**30** 109]. The two cannot be separated by means of

their descriptions, but Galvão states in correspondence that the basal spine is a little more compressed and coarse in *A. vargasi*. The existing material of *A. gilesi* does not admit of a better comparison. As a result of the study of *A. vargasi*, the subgenus is redescribed and the characters separating it from others are discussed.

Cova-García (P.) & Gómez Marcano (A.). **Estudios sobre anofelinos. Serie II. 3. Emergencia de *Anopheles rangeli* de una pupa en estado de sequedad.** [Studies on Anophelines. Series II. 3. Emergence of *A. rangeli* from a dry Pupa.]—*Publ. Div. Malariol.* no. 7 pp. 57–58. Caracas, 1941. (With a Summary in English.)

The emergence is recorded of a male of *Anopheles rangeli*, Gabaldon, Cova-García & López, from a dry pupa that had been adhering for a considerable time, probably several weeks, to the walls of a flask. It is suggested that certain Anophelines may pass the dry season as dry pupae and emerge in large numbers during the first rains.

[**Mosquito Control Work in 1938–41.**]—*Proc. N. J. Mosq. Ext. Ass.* **26** 228 [+3] pp., 4 pls., text ill., refs. New Brunswick, N.J., 1939. *Op. cit.* **27** 203 [+3] pp., 9 pls., text ill., refs. 1940. *Op. cit.* **28** 211 [+3] pp., 8 pls., text ill., refs. 1941. **29** 166 [+4] pp., 14 pls., refs. 1942.

These four reports, for 1938, 1939, 1940 and 1941, respectively, are similar in arrangement to previous ones [*cf. R.A.E.*, B **27** 28], and in addition to accounts of control work in various parts of the United States and other papers, primarily of local interest, each of the first three contains surveys of the advances in knowledge on mosquitos throughout the world in the year under review, by F. C. Bishopp & J. L. Webb, and of mosquito suppression work in Canada, by A. Gibson, and the last one contains a review of mosquito work throughout the world in 1941 by Bishopp and H. H. Stage. Other papers are noticed below, the numbers of the reports containing them and the pages being given in brackets after the authors' names.

In "A documented Record of a long Flight of *Aëdes sollicitans*," by D. P. Curry (**26** pp. 36–39, 1 map), it is recorded that a ship was invaded by a large swarm of *Aëdes sollicitans*, Wlk., when 110 miles from land off Cape Henry, Virginia, on 11th September 1927, and that an examination of the weather charts for the day indicated that the probable source was the Dismal Swamp area of North Carolina.

In "Does *Culex territans* (Walker) bite *Homo sapiens* (Linnaeus)?" by J. L. Clarke (**27** pp. 127–137, 3 refs.), evidence is presented in support of the theory that records of *C. territans*, Wlk., as a troublesome biting species in various parts of the United States arise from its confusion with *C. pipiens*, L., and *C. fatigans*, Wied. (*quinquefasciatus*, auct.). Descriptions are given of observations under natural and laboratory conditions showing that this species practically never bites man, its biting rate expressed in mosquito-exposure-minutes being 1 : 24,637, while that of *C. pipiens* was 1 : 140. Control measures where *C. territans* breeds alone are therefore unnecessary and wasteful.

In "Distribution of *Aëdes vexans* Eggs," by C. Filsinger (**28** pp. 12–19, 4 figs.), are recorded the results of the examination of more than 50 sods one foot square and 2½–6 ins. thick from various areas in three counties of New Jersey to determine the distribution of eggs of *Aëdes vexans*, Mg. Sods offering good cover, such as tussock grass and smartweed, produced large numbers of larvae, while those with short grass produced few, if any, and bare ones, those with long grass or mixed weeds or those obtained from tree-shaded, infrequently flooded or drained areas produced none. Few larvae emerged from sods submerged without drying. Sods dried for 5–7 days at 75°F. produced about 90 per cent. of the available larvae on submergence for 24 hours and the remainder after redrying and resubmergence. Sods dried for more than two

weeks at 75°F. produced no larvae. About half of the eggs were more than two inches below the soil line. Water was found to be able to move eggs horizontally and vertically. Eggs varied from 0·001 to 0·05 inch in diameter, and larvae that hatched from eggs markedly subnormal in size remained relatively small throughout their development, in spite of optimum food and temperature conditions.

In " Studies of the Effect of Reduction of Surface Tension on Mosquito Pupae," by M. A. Manzelli (**28** pp. 19–23, 3 figs.), descriptions are given of the functions of the respiratory trumpets of a mosquito pupa, the tips of which normally protrude through the surface film of water and are held there by surface tension, enabling the pupa to keep its balance, although the top is the heavier part, and the mechanism that makes submergence possible. When the surface tension of water is reduced by the addition of a wetting agent, all the pupae in it turn on their sides and die in a few hours. Their inability to maintain their equilibrium is not attributable to any toxic action of the chemical, as pupae transferred to fresh water after three minutes in water treated with 1 part actual soap per 100, 200, 400 or 1,000 became normal at once. However, while those that had been in the water containing the two lowest concentrations of soap remained normal, the other two batches died, so that toxic action was involved in the higher concentrations. All pupae that were allowed to remain in any of the soap solutions died. Reduction of surface tension would also cause any egg raft or any female alighting on water for oviposition to sink and would kill larvae that managed to hatch. The use of wetting agents for mosquito control is therefore suggested in places, such as barrels, where additional dilution cannot occur. A neutral wetting agent is desirable, as soap might combine with other substances in the water to form an insoluble material.

" Comparative Resistance of several Species of Mosquitoes to Larvicides," by H. H. Stage & W. W. Yates (**28** pp. 119–126, 1 fig., 2 refs.), deals with experiments on the toxicity of a pyrethrum larvicide (an emulsion of oil containing pyrethrum extract), a light Diesel oil, phenothiazine (used in a solution already noticed [*R.A.E.*, B **27** 53]) and a Paris green dust to the predominant species of *Aëdes*, *Culex*, *Theobaldia* and *Anopheles* occurring in the Pacific North-west. Larvae of the four genera showed considerable differences in their resistance to the larvicides in laboratory tests. *Aëdes* and *Anopheles* were the least resistant to Diesel oil and *Culex* the most resistant, *Aëdes* the least resistant to the pyrethrum larvicide and *Anopheles* the most so, *Anopheles* the least resistant to phenothiazine and Paris green, *Theobaldia* the most resistant to phenothiazine and the pyrethrum larvicide, and *Culex* the most resistant to Paris green. Larvae of *Aëdes vexans*, Mg., were slightly but consistently more resistant to Diesel oil, the pyrethrum larvicide and Paris green than were those of *A. lateralis*, Mg. Larvae of *C. pipiens*, L., and *C. tarsalis*, Coq., showed about the same degree of resistance to the larvicides other than Paris green, to which *C. pipiens* was the more resistant. Although there were inconsistencies in the rate of kill, it appeared that the four instars of *Aëdes*, *Culex* and *Theobaldia* became progressively more resistant to larvicides after each moult, but there appeared to be a period just before pupation when resistance was lowered. This period was least marked in *Aëdes* ; *Anopheles* was not tested. *Aëdes* and *Culex* pupae were more resistant to the pyrethrum larvicide than to Diesel oil. *Culex* pupae were somewhat more resistant to Diesel oil and far more resistant to the other larvicides than *Aëdes* and *Theobaldia* pupae. *Theobaldia* larvae and pupae were killed in about equal percentages by the larvicides used.

In " Factors that may affect the Toxicity of Pyrethrum-oil Emulsions as Mosquito Larvicides," also by Yates & Stage (**28** pp. 127–135, 5 refs.), tests designed to ascertain the reason for the inconsistency sometimes shown in results obtained with emulsions of oil containing pyrethrum extract are described. The emulsions contained 66 per cent. oil and were diluted with 9

parts water for application. Typical third- and fourth-instar larvae of *Aëdes vexans*, Mg., and *A. lateralis*, Mg., or *Theobaldia incidens*, Thoms., were used, and the tests were carried out at 75°F. The standard emulsion was emulsified with 1 per cent. potassium coconut-oil soap. Of other emulsifiers tested, triethanolamine oleate at 3·6 per cent. produced an excellent emulsion, but reduced toxicity by at least 10 per cent.; the same substance at 2 per cent. gave an emulsion comparable in character and toxicity with the standard. Calcium caseinate, blood albumin, egg albumin, sodium silicate and bentonite were all tested at a concentration of 2 per cent. Calcium caseinate and bentonite made stable but viscous emulsions, which broke too quickly when diluted to be satisfactory; the albumins and sodium silicate made unstable emulsions that soon deteriorated. The albumins and calcium caseinate reduced the kill of mosquito larvae by from 10 to 25 per cent.; bentonite and sodium silicate did not reduce toxicity. Waste liquors (fatty acids and liquid resins) produced by paper mills using pine woods were tested at 1 and 2 per cent. and gave emulsions that were equal in every respect to the standard if 1 per cent. sodium hydroxide was added. Sulphated alkylated diphenyl, sodium lauryl sulphate, a sodium salt of an alkylated naphthalene sulphonate and several oil-soluble emulsifiers all made satisfactory emulsions, and their toxicity compared favourably with the standard soap emulsion. Soap emulsions prepared with 0·75 or 1·5 per cent. dry coconut-oil soap, 1 per cent. potassium fish-oil soap or 0·75 per cent. dry coconut-oil soap to which 1 per cent. sodium hydroxide was added were all satisfactory in physical structure and gave satisfactory kills. The addition of 1 per cent. of sodium hydroxide did not appear to aid the emulsion in any way except when used with hard or impure water, when it retarded the breaking down of the emulsion. No appreciable difference in toxicity was observed between emulsions prepared with Diesel oil, stove oil and kerosene, the specifications of which are given. Several activators, including 18 organic compounds, mostly oils, were tested with the emulsion, but since the best of them increased its toxicity only moderately, it is doubtful whether their use would be economical. Concentrated standard emulsions were stored at 70°F. for several years without losing their toxicity. Emulsions stored at 100°F. broke down and lost their toxicity after a few weeks. Those stored at 35°F. deteriorated much more slowly. Laboratory tests showed that the toxicity of the emulsion is greatly reduced in water having a temperature below 60°F. The point at which the kill was greatly accelerated lay between 60 and 63°F. for *Aëdes* larvae and between 65 and 68°F. for *Theobaldia* larvae. Heavily polluted water and water containing large amounts of débris required substantially larger amounts of the emulsion per acre to effect satisfactory kills than clear water. Having been treated with 50–60 U.S. gals. diluted emulsion per acre, they had to be retreated before kill was satisfactory.

In "*Mansonia perturbans* (Walk.) on Cape Cod," by R. L. Armstrong (**28** pp. 184–188, 2 pls., 4 refs.), a detailed account is given of observations on the bionomics of this mosquito on Cape Cod, where it is the most troublesome species and where over 60 breeding places have been located. Adults were taken between 16th June and 19th September and were most abundant between 1st July and 15th August. They probably fly several miles. They do not attack by day, when they rest in heavy grass and shrubs, but become suddenly active at night, when they will enter houses through very small openings. They are strongly attracted to man and also readily attack horses and fowls. The appearance of a marsh and the consistency of the turf are better guides to potential breeding places than the species of plants found. Soft turf with a certain amount of free water above or below the roots is preferred. Breeding places may be located by pulling up suspected plants and washing the earth through a sieve or by using an emergence trap, one of which, covering an area of 7 sq. ft., caught 1,783 emerging adults during one season. As drainage is often impracticable, attempts are being made to develop other control

measures, which are discussed. They include the elimination of favoured plants, oiling during the period of adult emergence to kill the pupae when they come to the surface and to discourage egg laying, lowering the water level to expose breeding places from 20th June to 15th August, and so prevent adult emergence and discourage oviposition, and establishing a layer of sand several inches thick over the roots of favoured plants to discourage breeding.

In "Soil Sampling for studying Distribution of Mosquito Eggs on Salt Marshes in Florida," by G. H. Bradley & B. V. Travis (**29** pp. 143–146), a method is described of sampling the soil of salt marshes in Florida for eggs of *Aëdes* spp., chiefly *A. taeniorhynchus*, Wied., and *A. sollicitans*, Wlk., to supplement larval surveys in estimating populations. The eggs of these mosquitos are laid on damp soil and their development is completed in a few days, though they do not hatch until the soil is flooded. Segments of soil 8 sq. inches in area and 1 inch thick were removed with a special implement, numbered, stored for a week if necessary to permit the eggs to develop, and flooded. A study of the results shows that the relative importance of the various marshes was determined fairly accurately from a single batch of samples taken from each marsh when it was dry and flight of mosquitos had recently occurred (July, August and September). However, even at this season, each batch must consist of a large number of samples. Soil-sampling data and general observations showed that few eggs remain on the marshes throughout the winter. In the winter and early spring, eggs were found readily in miscellaneous places, such as pond rims and areas of poor drainage adjacent to the marshes.

"Malaria Control in Venezuela," by A. L. Berti (**29** pp. 156–158), is a brief account of the work of the Division of Malariology in Venezuela, where malaria is prevalent in almost all areas up to 1,600 ft. It is stated that about 30 species of *Anopheles* have been reported from Venezuela, about half of them since 1936. The malaria vectors are *A. albimanus*, Wied., on the coast and *A. darlingi*, Root, inland, the latter being the more dangerous. A list is given of four species recently described from Venezuela [*R.A.E.*, B **29** 177, 178; **30** 186].

"Experiments with three Types of Pyrethrum Oil Emulsions of the New Jersey Mosquito Larvicide," by J. M. Ginsburg (**29** pp. 159–162, 1 pl.), deals with tests of the New Jersey larvicide (a 66 per cent. emulsion of oil containing pyrethrum extract [*R.A.E.*, B **23** 205]), modified by omitting the water and using emulsifiers soluble in the oil. Such a change would eliminate the danger of freezing during winter storage and reduce volume for storage and transport. If 1–4 per cent. of the emulsifier is incorporated, a quick-breaking emulsion results, and with 15–25 per cent. emulsifier a permanent or water-miscible oil emulsion is obtained. The tests, which were made with a stable emulsion (the New Jersey larvicide), a quick-breaking emulsion and a permanent emulsion, all mixed with water for application in proportions to give concentrations of 6·6 per cent. oil and 0·007 per cent. pyrethrins, dealt with the relationship between the nature of the oil film deposited on water and toxicity to mosquito larvae (third and fourth instars of *Aëdes aegypti*, L.). All were applied at 50 U.S. gals. per acre to small dishes of water. The stable emulsion produced the most uniform surface film, with oil droplets averaging 3 microns in diameter, and gave 100 per cent. kill. The quick-breaking emulsion, which had an average oil droplet size of 15 microns, gave only 80–90 per cent. kill, and the miscible oil, the droplets of which were smaller than 1 micron, only 65–70 per cent.

HAMMON (W. McD.) & HOWITT (B. F.). **Epidemiological Aspects of Encephalitis in the Yakima Valley, Washington : mixed St. Louis and Western Equine Types.**—*Amer. J. Hyg.* **35** no. 2 pp. 163–185, 5 figs., 27 refs. Lancaster, Pa., 1942.

An account is given of various aspects of the epidemiology of a mixed outbreak of western equine encephalomyelitis and St. Louis encephalitis that

occurred in man and horses in the Yakima Valley, Washington, in 1940 [*R.A.E.*, B **29** 194]. There was no evidence that a large proportion of the cases had been bitten by any Arthropod other than mosquitos; *Triatoma sanguisuga*, Lec., has been found naturally infected with the western strain of equine encephalomyelitis in Kansas [**29** 38], but no species of *Triatoma* is known to occur further north than California. The mosquitos collected from the region during the epidemic were *Culex tarsalis*, Coq., which was taken in the largest numbers and in several localities, *C. territans*, Wlk., *C. pipiens*, L., *Theobaldia inornata*, Will., *T. incidens*, Thoms., *T. impatiens*, Wlk., *Anopheles maculipennis*, Mg., *A. punctipennis*, Say, *Aëdes dorsalis*, Mg., *A. vexans*, Mg., and *A. nigromaculis*, Ludl. Previous experiments have shown that the three species of *Aëdes* can transmit either the eastern or the western type of virus of equine encephalomyelitis [**25** 7; **29** 39], and that *C. pipiens* can transmit the virus of St. Louis encephalitis [**29** 194; *cf.* also **30** 161]. The viruses of St. Louis encephalitis and western equine encephalomyelitis have recently been isolated from examples of *C. tarsalis* taken in the Yakima Valley in 1941 [**29** 194].

Liu (Wei-t'ung), Zia (S. H.), Chung (H. L.) & Wang (C. W.). **Typhus Fever in Peiping. Epidemiological Considerations.**—*Amer. J. Hyg.* **35** no. 2 pp. 231–250, 1 map, 1 fig., 38 refs. Lancaster, Pa., 1942.

When it was found that flea-borne murine typhus existed in Peiping [*R.A.E.*, B **28** 129], the question arose as to whether the type previously recorded in epidemics in China and transmitted by lice [*Pediculus humanus*, L.] corresponded to the classical louse-borne disease or to an epidemic variety of murine typhus. Recent work indicates that epidemics may originate from rodent reservoirs [**29** 137; **30** 21–22]. Data on cases recorded in the Peiping Union Medical College Hospital between July 1921 and June 1940 are therefore summarised. Of 491 cases, 449 were from Peiping. It appears from the others that typhus is present in endemic form or in epidemics in certain cities and towns in Hopei and the adjoining provinces in northern China and in some provinces in central China. The cases in Peiping fell into three groups, the first comprising obviously epidemic ones occurring among people living very close together and usually heavily infested with lice, the second comprising persons who, whether infested with lice or not, had had contact with similar cases or with louse-infested people, and the third comprising persons who had not had any contact with lice or with other patients. Like the louse-borne cases, those of the third group occurred in or near the same premises in different years. Practically all the patients admitted the presence of rats or mice in their houses and many that of fleas. Typhus occurred throughout the year, but its incidence was lowest in July, when most baths were taken, and high in spring, when the lice begin to move to the outer layers of clothing, and in autumn, when *Xenopsylla cheopis*, Roths., is most abundant. All gradations of cases from mild to severe occurred. Typical clinical histories are given of a severe louse-borne and a mild flea-borne case. It appears that sporadic cases of murine typhus may occur simultaneously or in quick succession in the same premises and that there are probably instances of inapparent or subclinical murine typhus in man.

Russell (P. F.) & Badri Nath Mohan. **Some Mosquito Hosts to Avian Plasmodia with Special Reference to** *Plasmodium gallinaceum*.—*J. Parasit.* **28** no. 2 pp. 127–129, 11 refs. Lancaster, Pa., 1942.

A list is given of mosquitos that have been recorded as hosts of avian malaria parasites other than *Plasmodium gallinaceum*, and it is stated that the authors have found that *Culex bitaeniorhynchus*, Giles, *C. gelidus*, Theo., *C. whitmorei*, Giles, and *C. theileri*, Theo., are suitable hosts of *P. praecox* occurring in sparrows in the Nilgiris area of Madras Presidency. Various mosquitos found in this area were fed on fowls infected with a strain of *P. gallinaceum* from Ceylon and were then kept at 70–85°F. and 75–85 per cent. relative humidity. Sporozoites

appeared after 9–12 days in *Armigeres obturbans*, Wlk., *A. kuchingensis*, Edw., *A. aureolineatus*, Leic., *Aëdes aegypti*, L., *A. albopictus*, Skuse, *A. unilineatus*, Theo., *A. pseudalbopictus*, Borel, *A. vittatus*, Big., *A. scutellaris*, Wlk., *A. pseudotaeniatus*, Giles, *A. chrysolineatus*, Theo., and *A. pallirostris*, Edw. The nature of the breeding place of each of these species is briefly indicated. Repeated attempts to obtain development of *P. gallinaceum* in *Culex fatigans*, Wied., *C. mimeticus*, Noé, *C. bitaeniorhynchus*, *Anopheles stephensi*, List., and *A. jeyporiensis*, James, were unsuccessful. *Armigeres obturbans*, *A. kuchingensis*, *Aëdes albopictus* and *A. aegypti* were the species most suited to the development of very heavy sporozoite infection of the salivary glands. *Armigeres* spp. would feed at any time during daylight, but especially well in the afternoon. *Aëdes* spp. fed most avidly in the morning, but would also feed at other times, even at night.

Carvalho (J. C. M.). **Note on the Association of the Tick, *Ornithodoros talaje* (Guérin-Meneville), with Bat Infestations in human Dwellings in Brazil.**—*J. Parasit.* **28** no. 2 p. 165. Lancaster, Pa., 1942.

In 1939, examples of *Ornithodoros talaje*, Guér., were found on the ceiling of a farmhouse infested with bats and in beds in a house in a neighbouring district of Minas Geraes. There were numerous other reports of the finding, on the bamboo ceilings of houses, of a tick that was increasing in numbers and attacked man, causing oedema and severe itching. Large numbers of the bat, *Histiotus velatus*, were present in two farmhouses, and adult and two nymphal ticks were taken where the bats rested during the day. In one house, where the ticks were stated to fall frequently from the ceiling, they disappeared when the place was cleared of bats. So far as the author is aware, this is the first record of the occurrence of *O. talaje* as a parasite of bats in dwellings. He believes that in such places, the adults are strictly parasites of bats ; only the larvae and nymphs bite man.

Lent (H.). **Estudos sôbre os triatomideos do Estado do Rio Grande do Sul, com descrição de uma espécie nova.** [Studies on the Triatomids of the State of Rio Grande do Sul, with a Description of a new Species.]—*Rev. brasil. Biol.* **2** no. 2 pp. 219–231, 1 fldg. map., 33 figs., 29 refs. Rio de Janeiro, 1942.

A description is given of the adults of both sexes of *Panstrongylus tupynambai*, sp. n., which was taken in 1942 in a dwelling in Rio Grande do Sul, together with records of the local distribution of the other five Triatomids that occur in that State, showing, in some cases, their habitats and the animals they attack. *Triatoma infestans*, Klug, is the commonest species, and is frequently found infested with *Trypanosoma* (*Schizotrypanum*) *cruzi*. One example of *Triatoma* (*Eutriatoma*) *sordida*, Stål, was found infected with this trypanosome in 1942. *Triatoma* (*E.*) *rubrovaria*, Blanch., shows considerable variation and some examples taken in Rio Grande do Sul were indistinguishable from *T. gomesi*, Neiva & Pinto [*R.A.E.*, B **11** 136], which is therefore considered a synonym of it.

Flea and Louse Control.—*Soap* **17** no. 12 pp. 115–117, 1 fig. New York, N.Y., 1941.

Although many powders for the control of fleas and lice on man and animals in the United States are still based principally on pyrethrum, there has been a marked increase in the use of rotenone derivatives in these products in the past 5 or 6 years. Derris root has been used in England in such powders for over 20 years. A standard product in the United States for use on domestic pets consists of 1 per cent. rotenone and 2 or 2½ per cent. other derris resins in inert dust, but some products contain less rotenone and a percentage of pyrethrum for quick action. A rotenone powder is considerably cheaper than a pyrethrum powder. Rotenone is also used in conjunction with sulphur. Most of the

products are recommended for the control of lice and ticks as well as fleas, and their use to control chiggers [*Trombicula*] and *Pediculus humanus humanus*, L. (*P. h. corporis*, DeG.), *P. humanus* [*capitis*, DeG.] and *Phthirus pubis*, L., on man is commonly suggested. Powders made with rotenone and a talcum base cannot be used for controlling lice on canaries as they give these birds mechanical pneumonia ; only pyrethrum powder alone can safely be used. Attention is drawn to the fact that fleas can survive for several weeks without food, so that it is not sufficient to clear a dog or cat from infestation. The breeding places of the fleas must be treated also by sweeping up any refuse and spraying under pressure with ½ U.S. gal. liquid fly spray or diluted coal tar disinfectant per 1,000 sq. ft. Where rugs and furniture are infested, the fleas may be killed by spreading flake naphthalene over the floor and furniture at the rate of about 5 lb. to a normal-sized room and closing the room for a day, or by spraying thoroughly with a fly spray. In severe infestations, fumigation with hydrocyanic acid gas or methyl bromide may be resorted to. An insecticidal shampoo is an alternative to a dusting powder for domestic pets and for the control of *Phthirus pubis* and *Pediculus h. capititis* on man. A well-known one consists of 20 per cent. coconut-oil soap with the addition of camphor oil, pyrethrum, rotenone and derris resins.

Derris or cubé used in the form of a powder containing 3 per cent. rotenone is effective against all lice on man. In treating *P. h. capitis*, close clipping of the hair is a help, but not essential, and the powder can also be used as a wash made up of 5 level tablespoonfuls powder, 2 level tablespoonfuls neutral soap and 1 U.S. quart warm water, applied twice at an interval of 10 days. Other treatments against *P. h. humanus* are a liquid soap made up of 1 part soap chips boiled in 4 parts water with the addition of 2 parts kerosene, and two powders consisting, respectively, of 40 gm. talc, 1 gm. naphthalene, 1 gm. iodoform and 2 cc. creosote, and 40 gm. talc, 1 gm. sulphur and 2 cc. creosote [*cf. R.A.E.*, B **6** 189]. For *Phthirus pubis*, ointments made of 1 part by volume derris or cubé powder (4–5 per cent. rotenone) in 10 parts petroleum jelly are effective, and successful use of an ointment containing pyrethrins has also been reported [**30** 72].

Cutting grass and undergrowth and applying sulphur at about 1 lb. per 1,000 sq. ft. several times at intervals of one week is the normal control for *Trombicula*, and sulphur dust has been used for many years for dusting the body and clothing against these mites. A new product that is understood to have hydrogenated rotenone as its active ingredient is reported to have reduced bites by 90 per cent. when applied to the ankles, wrists, legs and neck in extensive field tests during army manoeuvres.

The use of rotenone for the control of lice on farm animals has increased enormously in recent years in spite of prejudice in favour of better-known products, the defects of which are reviewed. The rotenone content of dusting powders for louse control is commonly much lower than that necessary in flea powders, about ½–1 per cent. being sufficient. Lists are given of the fleas that are found associated with human dwellings and of the more important species of lice attacking fowls, cattle, pigs and goats.

Mailen (T. H.) & Fenton (F. A.). **Repellency in Cattle Sprays.**—*Soap* **17** no. 12 pp. 133, 135, 1 fig., 3 refs. New York, N.Y., 1941.

The one-half cow method of testing the repellency of livestock sprays to blood-sucking flies in the field [*cf. R.A.E.*, B **30** 70] is considered the most efficient as it eliminates the factor of variation in the attractiveness of individual animals [**30** 27–28]. A description is given of an apparatus that forms an effective shield to prevent spray mist from being carried over from one side of the cow to the other, does not rub off the spray as a blanket type of shield does, and does not transmit materials used on cows in one test to others sprayed with different materials in subsequent tests. A formula is given by means of which

the value of a spray that is being tested by this method may be expressed as the increased repellency it exercises in comparison with another spray applied to the opposite side of the same animal, or as total repellency as compared with an unsprayed side. It is recognised that the position of the cow in relation to the prevailing wind may affect the distribution of flies on it, and that the repellent factor may be carried over by the wind or other means and influence the comparative numbers of flies on the test sides, but these factors tend to be cancelled out in several days' testing of like materials.

McGovran (E. R.) & Fales (J. H.). **Roach Testing. A progress Report describing a new Method of testing Roach Sprays.**—*Soap* **18** no. 3 pp. 101, 103, 105, 107, 117, 2 figs., 5 refs. New York, N.Y., 1942.

Laboratory tests of insecticides should provide as many as possible of the conditions under which the insect is actually controlled. The natural habitat of cockroaches is extremely difficult to reproduce. Three recently published methods of testing petroleum-base sprays against cockroaches [*R.A.E.*, B **30** 71] provided considerable information on the possibilities and limitations of laboratory tests of such sprays. An attempt has been made to devise a method by which it would be possible to apply a variable, but exact, quantity of direct spray to the cockroaches, to measure the effect of the spray actually deposited on them and to reduce as far as possible the effect of fumigation, residue on sprayed surfaces and droplets in the air. It was also desired to determine the difference in resistance of males, females and nymphs to sprays of pyrethrum extract in petroleum oil. When a petroleum-oil spray is discharged directly on to the cockroaches at close range, the amount deposited on them is usually more than enough to cause complete mortality. In the method here described in detail, which was tested against *Blattella germanica*, L., the deposit of spray was controlled by an opening in a horizontal partition that swung rapidly backwards and forwards like a pendulum through the spray stream. The spray passed through a hole $\frac{3}{4}$ in. in diameter and struck the cockroaches confined in a rotating circular metal container $3\frac{1}{2}$ ins. in diameter. The methods of selecting and preparing the cockroaches are described. In numerous comparable tests of sprays ranging in pyrethrin content from 1 to 5 mg. per ml. and in deposit from 2·6 to 0·8 mg. per sq. cm., the average mortalities of males, females and nymphs were 98, 73 and 87 per cent., respectively [*cf.* **27** 18]. It is concluded that tests should be carried out with adult females. In six similar tests in which 7·3 mg. of highly refined kerosene without pyrethrum was deposited per sq. cm., the corresponding figures were 60, 41 and 97. The mortality of males approached its maximum on the first day, that of females rose until the fifth day, and that of nymphs occupied an intermediate position. The addition of sesame oil to the spray did not improve kill.

Sweetman (H. L.) & Laudani (H.). **Sodium Fluoride.**—*Soap* **18** no. 4 pp. 90–93, 3 figs., 8 refs. New York, N.Y., 1942.

Earlier work on the action of sodium fluoride on cockroaches is reviewed, and an account is given of experiments on its effectiveness as a stomach poison [*cf. R.A.E.*, B **29** 144] against *Periplaneta americana*, L., and as a contact poison against this species and *Blattella germanica*, L. When dosages varying from 0·039 to 10 mg. were injected into the guts of chilled or normal adults of *P. americana*, individuals that received 0·078 mg. or less showed no ill effects after 10 days, while one that received 0·156 mg. died in 250 minutes, a chilled one that had received 10 mg. died in 2 minutes and a normal one in 7 minutes. However, when several kinds of food dusted with sodium fluoride were offered to the cockroaches, they failed to eat any and even avoided it. It is therefore concluded that sodium fluoride is of no practical use as a stomach poison for their control. To test its contact action, numbers of cockroaches of each species were allowed to pass through a runway that had been dusted with sodium

fluoride. The mouthparts of half of them were sealed to prevent their removing and ingesting the poison. Both species tended to avoid it at first, but their antennae soon became contaminated during exploratory movements, after which they showed little ability to detect and avoid it. A greater percentage of individuals of *P. americana* with sealed mouthparts was killed than of those with normal ones, and on an average death occurred after about 40 hours in the first case and about 60 in the second. Efforts to remove the poison were energetic, but there was no evidence that any was swallowed during the process. It accumulated in considerable quantities on the surface below the mouthparts. All individuals of *B. germanica* were killed, the average time required for those with sealed mouthparts being the same as for *P. americana*, while those with normal mouthparts died almost as quickly. Members of this species made only slight attempts to remove the poison. An attempt to ascertain the amount of poison that adhered to the cockroaches by weighing them was unsuccessful. A five-point scale was therefore used, and the deposit classed by observation as very much, much, moderate, little, or very little. The number of hours between treatment and death was found to be closely correlated with the deposit.

The authors' experience in practical control work supports the results of these experiments. Cockroaches were readily controlled or eradicated by thorough and repeated applications of sodium fluoride as a pure or a diluted dust. It retained its effectiveness as long as it remained dry, but if it became damp, the cockroaches could run over it with impunity. Treatment must, therefore, be repeated more often in moist situations than in dry ones.

ANNAND (P. N.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine 19**[40–]**41.**—120 pp. Washington, D.C., U.S. Dep. Agric., 1941.

Part of this report (pp. 91–95) on entomological work in the United States in 1940–41 deals with Arthropods affecting man and animals. In an area in which heartworm [*Filaria immitis*] of dogs is a local problem, it was found to be transmitted by *Aëdes taeniorhynchus*, Wied. Studies in the north-western States showed that eggs of *A. vexans*, Mg., and *A. lateralis*, Mg., will remain viable in the soil for at least 7 years [*cf. R.A.E.*, B **29** 137], although after 5 years less than 1 per cent. as many eggs hatched as previously. Breeding of sandflies [*Culicoides*] was controlled in experiments in Florida by diking a large acreage of pickleweed [*Batis maritima*] and mangrove [*cf.* **27** 217], both larval and adult populations being reduced by 90 per cent. in the diked marshes. Evidence was obtained that populations of the American dog tick [*Dermacentor variabilis*, Say] can be consistently though slowly reduced in a heavily infested area by poisoning meadow mice [*Microtus*], the favourite host of the nymphs [*cf.* **29** 137], and systematically dipping all dogs, the preferred host of the adults.

A new healing agent for purulent wounds, ammonium allantoinate, was discovered in the secretions of fly maggots [*cf.* **30** 36], and another discovered in such secretions and designated extract K is of value in the treatment of osteomyelitis. Eighty medical products originally discovered in the secretions of insects are now prepared synthetically, and about 200,000 cases of non-healing wounds have been treated with them in the United States.

Of some 200 mixtures tested under both laboratory and field conditions for the treatment or prevention of infestation of domestic animals by screwworms [*Cochliomyia hominivorax*, Coq.], 12 proved to be superior to any previously developed. The most practicable, easily available and cheapest and the one that was most effective for treating severe cases and protecting wounds from infestation was a combination of 35 per cent. diphenylamine (technical), 35 per cent. benzene (90 per cent. commercial benzol), 10 per cent. sulphonated castor oil (turkey red oil, pH 7 or 10) and 20 per cent. lampblack (Germantown) known as formula 62. It is effective against all species of fly larvae that normally infest wounds of animals and with modifications has also proved of value against those causing fleece worm infestation (cutaneous myiasis of sheep) [**30** 44].

A method was developed by which accurate comparative tests could be made of the toxic and repellent action of various materials against flies, and pyrethrins and rotenone were found to be the most effective of the materials tested in controlling stable flies [*Stomoxys calcitrans*, L.] and horn flies [*Lyperosia irritans*, L.]. When sprays of these substances were applied to animals, the toxic action persisted almost undiminished for at least 7 hours. *L. irritans* was found to feed twice daily and consume an average of 1·71 mg. blood per feed. On this basis, the annual loss of blood from a heavily infested herd of 500 cattle on a ranch in Texas, where estimates of populations of the fly were made throughout the year, was calculated to be 312 U.S. gals. The larval and pupal periods of this fly were found to last about 4 and 5 days, respectively. Zinc oxide and zinc stearate, administered to cattle by the mouth, inhibited the development of larvae in the droppings. One dose per day of 1·5 gm. zinc oxide per cwt. body weight gave excellent results and caused no ill effects to animals treated for 30 days. Creosote oil diluted with 3 parts Diesel oil killed larvae of *S. calcitrans* if applied with a high-pressure sprayer to the drifts of fermenting vegetation in which they occur [**30** 60]. Breeding of this species was found to occur also in piles of celery strippings near celery-washing establishments.

The maximum duration of the egg stage of the short-nosed cattle louse [*Haematopinus eurysternus*, Nitzsch] was shown to be much longer than the minimum duration of the nymphal stage, so that this louse cannot be eradicated by two treatments with cubé and sulphur dip [**29** 137], no matter how they are spaced. Preliminary field tests demonstrated that cattle lice can be controlled by applying the dipping fluid with either hand- or power-operated sprayers.

The Blowfly takes heavy Toll of Sheep and Wool Industry.—*Agric. Gaz. N.S.W.* **53** pt. 2 pp. 59–72, 94, 10 figs. Sydney, 1942.

In view of the fact that *Lucilia cuprina*, Wied., causes an annual loss of £3,000,000 to the sheep and wool industry of Australia and the belief that at least 80 per cent. of this loss could be prevented by the general application of measures already known for the prevention and control of infestation, particularly by a judicious combination of all the best-known methods, these methods are briefly described in a series of articles under this general heading. The papers are: Breed Plain-bodied Sheep, by H. G. Belschner (pp. 60–62, 94); Direct Attack on Blowflies is unlikely to solve the Problem, by R. N. McCulloch (pp. 63–64); Jetting and Crutching for the Prevention of Blowfly Strike, by R. N. McCulloch (pp. 65–67); Prevent Crutch Strike by the Mules Operation, by J. C. Keast (pp. 68–69); Correct Docking of Lambs vastly reduces Crutch and Tail Strike, by J. C. Keast (p. 70); and Blowfly Dressings, by W. L. Hindmarsh (pp. 71–72).

PAPERS NOTICED BY TITLE ONLY.

DE OLIVEIRA (S. J.). **Sôbre os mosquitos do Estado de Mato Grosso, Brasil, com a descrição do macho de** *Taeniorhynchus* (*Rhynchotaenia*) *shannoni* (**Lane & Antunes, 1937**) **(Diptera, Culicidae).** [On the Mosquitos of the State of Matto Grosso (11 species taken in November–December 1941) with a Description of the Male of *Mansonia* (*T.*) *shannoni*.]—*Rev. brasil. Biol.* **2** no. 2 pp. 209–212, 5 figs., 5 refs. Rio de Janeiro, 1942. (With a Summary in English.)

GABALDON (A.), AGUILERA (C.) & ARÉVALO (A.). **Estudios sobre anofelinos. Serie II. 4. Espinas basales y accesorias anormales en los hipopigios de** *Anopheles albimanus*, *Anopheles goeldii* **y** *Anopheles nuñez-tovari*. [Studies on Anophelines. Series II. 4. Abnormal basal and accessory Spines in the Hypopygia of *A. albimanus*, Wied., *A. goeldii*, Rozeboom & Gabaldon, and *A. nuñez-tovari*, Gabaldon.]—*Publ. Div. Malariol.* no. 7 pp. 59–61, 2 figs., 1 ref. Caracas, 1941. (With a Summary in English.)

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ERRATA.

Page 33 line 19 for " (*Malareus*) " read " (*Malaraeus*) "
,, 56 line 5 for " carbitol to thiocyanate " read " carbitol thiocyanate "
,, 65 line 21 for " [*cf.* 30 000] " read " [*cf.* 30 60, 61] "
,, 108 3 lines from end for " *A. rondani* " read " *A. rondoni* "
,, 127 5 lines from end for " *Anacentor colombianus* " read " *Anocentor columbianus* "
,, 128 12 lines from end for " **Colombia** " read " **Columbia** "
,, 153 line 31 for " 1941 " read " 1940 "